THE JOURNAL OF

THE INSTITUTION OF PRODUCTION ENGINEERS

VOL. XXIX - No. 1 - January, 1950

Principal Contents :

Published by THE INSTITUTION,
36, PORTMAN SQUARE, LONDON, W.1

Telephone.
WELbeck 6813/7:
PRICE 5/-

REMINGTON RAND

SAFE CABINET

Certified Protection

Vital irreplaceable records and documents, the real value of which cannot be insured, can be given certified protection against fire and burglary in the Remington Rand Safe-Cabinet.

Fire causes enormous losses every year. Precast, monolithic construction, reinforced insulation, careful control at every stage of manufacture, and furnace testing of the finished product enable the Safe-Cabinet to be certified for a degree of fire-protection equal to the most severe fire hazards.

Safe-Cabinet doors swing easily on ball-bearing hinges, fold back flush with the safe when open, close with a double set of interlocking tongues. Bolts engage automatically when the door is closed. A drill-proof steel plate protects the locking mechanism against burglary. Ball-bearing castors make the safe easy to move.

★ *Write for new Illustrated Folder*

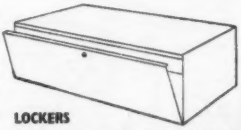
Remington Rand

REMINGTON RAND LIMITED (Dept. 31)
1 New Oxford St., London, W.C.1. Tel. CHAncery 8888

INTERIOR FITTINGS

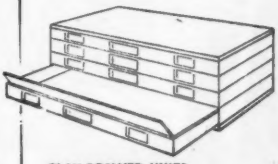
SHELVES

Safe-Cabinet shelves, ½" Plain or 1" Reinforced, are adjustable at 1½" intervals on the suspension strips at each side of the safe.



LOCKERS

Drop-front lockers, fitted with lock, can be inserted in the Safe-Cabinet exactly where they are most convenient as a private compartment.



PLAN-DRAWER UNITS

Plan-Drawer sections, one, two, three or more units as required, can be built up at any convenient point in the Safe-Cabinet. Each drawer is fitted with fixed back flap and hinged front flap to protect the drawings.

The Council of the Institution

1949-50

President

DR. H. SCHOFIELD, C.B.E., Ph.D.(Lond.,) B.Sc. Hons.(Lond.,) A.R.C.Sc.(Lond.,) D.I.C., A.M.I.C.E., M.I.Mech.E., A.M.I.E.E., M.I.Struct.E., F.Inst.P., F.I.I.A.

President-Elect

MAJOR-GENERAL K. C. APPLEYARD, C.B.E., T.D., D.L., J.P., M.I.Mech.E., A.I.M.E., M.I.Min.E.

Chairman of Council

J. E. HILL, A.M.I.Mech E.

Vice-Chairman

Walter C. Puckey, F.I.I.A.

Past Presidents

Sir George E. Bailey, C.B.E.
The Rt. Hon. Lord Sempill, A.F.C.
The Rt. Hon. Viscount Nuffield, G.B.E.
J. D. Scaife

Vice-Presidents

T. Fraser, C.B.E. J. H. Bingham, E. W. Hancock, M.B.E. J. A. Hannay

Section Presidents

H. Burke ..... *Birmingham*
Col. C. G. Warren-Boulton..... *Bombay*
T. R. Gupta..... *Calcutta*
A. F. Pool..... *Cornwall*
B. C. Harrison ..... *Coventry*
J. Lomax ..... *Dundee*
H. H. Dawson ..... *E. Counties*
J. L. Bennet..... *Edinburgh*
H. Gardner..... *Glasgow*
H. Nutton..... *Halifax*
J. Wombwell, M.B.E..... *Leicester*
B. A. Williams, O.B.E..... *Liverpool*
W. Core..... *London*
R. L. Paice ..... *Luton*
W. Symes ..... *Manchester*
E. Paton..... *New Zealand*
L. Walker ..... *N. Eastern*
R. Cairns..... *N. Ireland*
J. H. Bingham..... *Nottingham*
T. A. Westall..... *Preston*
L. R. Evans..... *Sheffield*
C. A. Clarke ..... *Southern*
W. J. Vaughan..... *S. Wales & Mon.*
R. S. Brown..... *Western*
A. J. Aiers..... *Wolverhampton*
J. Horn ..... *Yorkshire*

Additional Section Representatives

F. Bernard White..... *Birmingham*
F. C. White..... *Birmingham*
H. Eckersley ..... *Coventry*
J. Blakiston ..... *Halifax*
H. W. Bowen, O.B.E..... *London*
F. P. Laurens, O.B.E..... *London*
R. K. Allan ..... *Luton*
F. W. Cranmer..... *Manchester*
M. Seaman..... *Manchester*
J. F. Gibbons..... *N. Eastern*
A. S. Johnstone..... *Nottingham*
H. Kirkman ..... *Preston*
G. R. Pryor..... *Sheffield*
J. E. Attwood..... *Western*
H. Tomlinson ..... *Wolverhampton*
W. J. Marshall..... *Wolverhampton*
T. E. Phythian, M.B.E. *Yorkshire*

Chairmen of Standing Committees

J. E. Baty E. P. Edwards F. H. Perkins A. L. Stuchbery

Elected Members

F. Bloor, E. D. Broome, R. M. Buckle, B. H. Dyson, R. C. Fenton
H. G. Gregory, E. J. H. Jones, M.B.E., R. Kirchner, Prof. T. U. Matthew
H. J. Swift, O.B.E. M. H. Taylor, S. Wright

Australian Sub-Council

1949

President

E. C. PARKINSON

Chairman

E. L. OLFEN

Vice-Chairman

E. B. Richardson

Elected Members

H. le Cheminant W. G. Davis
J. Finlay F. Glover
S. D. McPhee C. Pullen
J. M. Steer J. E. Strick

South African Sub-Council

1949/50

President

A. C. WOTHERSPOON

Vice-President

J. RENWICK

Past Presidents

A. B. Anderson L. H. L. Badham
J. Henry D. Lion-Cachet

Elected Members

R. H. Arbuckle W. Caldwell
D. R. Ryder E. G. Fox
W. Gillespie G. Godfrey
D. A. Petrie W. Starr
H. H. Waters

Director and General Secretary of the Institution

Major C. B. Thorne, M.C.

Education Officer: T. B. Worth

Section Honorary Secretaries

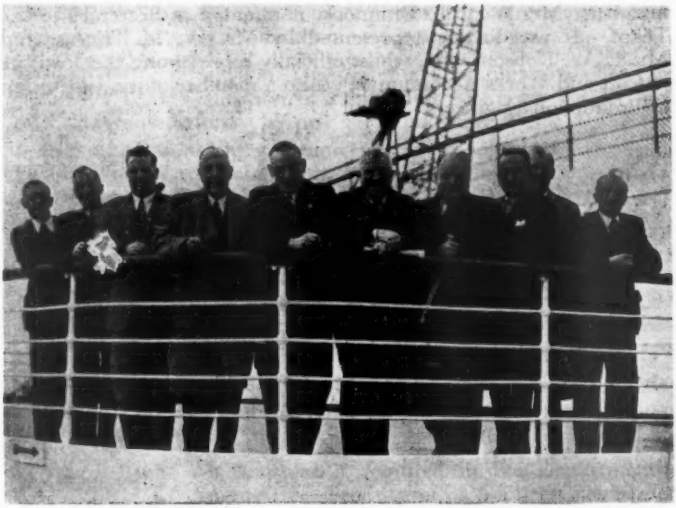
Birmingham	A. J. Mansell, 204, Alcester Road South, Birmingham, 14.
Bombay	E. H. Y. Burden, Machine Tools (India) Ltd., Imperial Chambers, Wilson Road, Ballard Estate, P.O. Box No. 522, Bombay, 1.
Calcutta	J. Warren-Boulton, Machine Tools (India) Ltd., Stephen House, Dalhousie Square, Calcutta.
Cornwall	F. W. Spencer, " Pembroke," Phillack, Hayle, Cornwall.
Coventry	A. Hill, 382, Ansty Road, Coventry.
Derby Sub-Section	A. Short, 9, Laburnum Grove, Kingsway, Derby.
Dundee	A. H. Webster, 8, Kinnordy Terrace, Craigiebank, Dundee, Angus.
Eastern Counties	L. A. Childs, Crane Ltd., Nacton Road, Ipswich.
Edinburgh	P. H. Lee, 39, Corstorphine Bank Drive, Edinburgh, 12.
Glasgow	W. P. Kirkwood, " Morar," Sandfield Avenue, Milngavie, Dumbartonshire.
Halifax	Miss N. E. Bottom (acting), Hopkinsons, Ltd., Huddersfield.
Leicester and District	C. F. Gazard, 27, Stretton Road, Leicester.
Lincoln Sub-Section	E. E. Ingleton, " Glenroy," Lincoln Road, North Hykeham. Lincoln.
Liverpool	O. Blenkinsop, 119, North Barcombe Road, Childwall, Liverpool, 16.
London	H. W. Townsend, Philips Electrical Ltd., New Road, Mitcham Junction, Surrey.
Luton and Bedford	R. M. Buckle, 238, Cutenhoe Road, Luton, Beds.
Manchester	R. S. Clark, 13, Fownhope Road, Sale, Cheshire.
Melbourne (Victoria, Australia)	C. Pullen, The Institution of Production Engineers, 3rd Floor, 18, Queen Street, Melbourne, C.1.
New Zealand	S. Mc L. Wallace, 21, Burwood Crescent, Remuera, Auckland.
North Eastern	H. B. Topham, C. A. Parsons & Co., Ltd., Heaton Works, Newcastle-upon-Tyne, 6.
Northern Ireland	W. G. Wyman, " Linden Lea," Cultra, Co. Down.
Nottingham	C. N. T. Manfull, Chellaston House, Thurgarton Street, Nottingham.
Preston	F. M. Kemp, Clayton, Goodfellow & Co., Ltd., Atlas Iron Works, Blackburn, Lancs.
Sheffield	E. Levesley, 259, School Road, Sheffield, 10.
Shrewsbury Sub-Section	R. O. L. Cadman, 5, Perseverance Terrace, East Road, Ketley Bank, Oakengates, Salop.
South Africa	The Secretaries, Institution of Production Engineers, Barclays Bank Buildings, Corner Commissioner and Harrison Streets, Johannesburg.
Southern	S. Caselton, (acting) 36, Portman Square, London, W.1.
South Wales and Monmouthshire	S. T. O. Davies, 4, St. Cadoc Road, Heath, Cardiff.
Sydney (New South Wales)	J. M. Steer, G.P.O. Box 1665, Sydney.
Western	A. Eustace, 19, Ferndale Road, Northville, Bristol, 7.
West Wales Sub-Section	H. P. Sanderson, I.C.I. Ltd., (Metals Division) Waunarlwydd, near Swansea.
Wolverhampton	W. J. Marshall, Moston Park, Lee Brockhurst, Salop.
Yorkshire	J. L. Townend, 26, Moor Allerton Drive, Street Lane, Leeds, 7.

Graduate Section Honorary Secretaries

Birmingham	J. Thompson, 113, Queens Road, Yardley, Birmingham, 26.
Coventry	S. Hey, 112, Moseley Avenue, Coventry.
Halifax	T. Marsden, 6, Kell Lane, Stump Cross, Halifax.
London	R. T. Mustard, 47, King's Road, Woodham, Weybridge, Surrey.
Luton	C. S. Brewer, 144, Hart Lane, Luton.
Manchester	G. H. Armes, 14, Fairmile Drive, East Didsbury, Manchester.
North Eastern	G. D. Robson, 86, Dryden Road, Low Fell, Gateshead.
Wolverhampton	R. W. Tomkys, 30, Church Road, Bradmore, Wolverhampton, Staffs.
Yorkshire	S. Metcalfe, 26, Highfield Avenue, Leeds, 12.

ANGLO-AMERICAN COUNCIL ON PRODUCTIVITY

Return of Specialist Team on Mechanical Aids



Left to Right: Mr. M. A. Jenkinson (Representing the Mechanical Handling Engineers Association), Mr. N. Macdonald (Representing the British Compressed Air and Portable Electric Tool Manufacturers Association), Mr. W. J. Dimmock, A.M.I.P.E., Secretary of Team (Representing the Institution of Production Engineers), Mr. A. Roebuck, Leader of Team (Representing the Institution of Mechanical Engineers), Mr. B. Gardner, General Secretary of the A.E.U. (Representing the T.U.C.), Mr. J. Young, General Secretary of the Association of Engineering and Shipbuilding Draughtsmen (Representing the T.U.C.), Mr. G. G. Taylor (Representing the Institution of Electrical Engineers), Mr. E. Williamson (Representing the Engineering and Allied Employers National Federation), Mr. L. W. Robson, A.I.P.E. (Representing the Institute of Cost and Works Accountants), Mr. W. M. Hiorns, A.M.I.P.E. (Representing the Institution of Production Engineers).

In welcoming the Specialist Team on Mechanical Aids on its return from America on Thursday, November 10th, the Director and General Secretary of the Institution of Production Engineers, Major C. B. Thorne, M.C., said that the Institution was vitally concerned in the adoption of methods which would increase output,

and reduce cost of production. The Institution would therefore place at the disposal of the Team all available facilities to enable their findings to be disseminated as widely as possible.

All hoped that considerable national advantage would be forthcoming as a result of the investigations made by the Team, which had visited the United States under the auspices of the Anglo-American Council on Productivity.

The Institution was particularly honoured by having one of its members, Mr. W. J. T. Dimmock, nominated as Secretary to the Team. It was further represented by Mr. W. M. Hiorns, and Mr. L. W. Robson, who, whilst officially representing the Institute of Cost and Works Accountants, is also a member of the Institution of Production Engineers.

INSTITUTION NOTES

January, 1950

INSTITUTION DINNER Members who have not yet applied for tickets for the Institution Dinner which is to be held at the Dorchester Hotel, Park Lane, W.1, on February 23rd, 1950, are reminded that they should do so not later than 31st January, 1950.

GRADUATESHIP EXAMINATION, 1950 1. The Graduateship Examination of the Institution of Production Engineers will be held on Friday and Saturday, April 21st and 22nd, 1950.

2. Examination Entry Forms, which are obtainable from the Head Office of the Institution, must be despatched *so as to reach Head Office not later than 10th March, 1950.*

3. No entry will be accepted unless accompanied by a Form of Application for Junior Membership, and the examination fee of ten shillings.

4. Candidates must be under 28 years of age.

5. Rules and Syllabus and copies of past two years' Examination Papers may be obtained from Head Office (price 3d. per set).

MEETING OF COUNCIL The Next Meeting of Council will be held on Thursday, January 26th, 1950, at 11 a.m., at 36, Portman Square, W.1, followed by the Annual General Meeting.

WOLVERHAMPTON & STAFFORDSHIRE TECHNICAL COLLEGE An Assistant is required in the Department of Engineering Production, a pioneer department which has conducted successful advanced courses in Production Engineering for many years.

Applicants should possess an engineering degree or equivalent qualification, and have good general engineering training.

The salary will be in accordance with the Burnham Technical Scale, £300 to £555, with allowances for training, degree or equivalent. The commencing salary will take into account previous teaching and industrial experience.

Further particulars and application form may be obtained from F. Lonsdale Mills, Esq., Clerk to the Joint Education Committee, Education Offices, North Street, Wolverhampton.

EMPLOYMENT FOR THE DISABLED The Institution is informed that Remploy Ltd. desire to appoint a Production Manager. This Company, which was established under the Disabled Persons Employment Act (1944), exists for the purpose of providing employment under special conditions in various parts of England,

Scotland and Wales, for those persons who are so severely disabled as to prevent their being employed in open industry.

The person appointed would be responsible for the supervision of layout and control of production in a number of factories dealing with a wide diversity of materials and products, and will need good basic qualifications. The salary will not be less than £1,000 per annum.

Remploy Ltd. have their headquarters at 25/28, Buckingham Gate, London, S.W.1.

RESEARCH PUBLICATIONS The following I.P.E. publications are available for sale, and may be obtained from the Production Engineering Research Association, Staveley Lodge, Melton Mowbray, Leicestershire.

" Practical Drilling Tests," price 21/-.

" Report on Surface Finish," price 15/6.

" Acceptance Test Charts for Machine Tools," Part I, price 5/6.

" Machine Tool Test Charts," Part III, price 5/6.

" Machine Tool Test Charts," Part IV, price 5/6.

" Machine Tool Research and Development," price 10/6.

NEWS OF MEMBERS

Mr. P. H. Khanna, is now Assistant Works Manager in the Carriage and Wagon Shops of the G.I.P. Railway, Matunga, Bombay.

Mr. L. G. Box, is now Efficiency Engineer with Massey Harris, Ltd., of Manchester and Kilmarnock.

Mr. A. Beecham, is now Works Manager of Courtaulds Limited Bakelite Moulding Department, Coventry.

Mr. E. Levesley, Hon. Secretary of Sheffield Section, is now Manager of the Process Planning and Machine Tool Department at the English Steel Corporation, Ltd., Sheffield.

Mr. E. J. Newcomb, has joined the staff of Schweppes, Ltd., London, as a Management Trainee.

Mr. W. R. Deione, has taken up an appointment as Works Manager, P.T. Dept., Broom and Wade, Ltd., High Wycombe.

Mr. C. E. A. Griffin, O.B.E., has been appointed Divisional Works Manager of the Motor Accessory Division of S. Smith & Sons (England) Ltd., Cricklewood.

BRITISH STANDARDS The following Standards have recently been issued and are obtainable from the British Standards Institution, 28, Victoria Street, Westminster, S.W.1.

825 : 1949 Mild steel shackles. (Price 5/-, post free.)
I.P.E. Representative on appropriate B.S.I. Committee : Mr. J. E. Baty.

649 : 1949 Reciprocating internal combustion engines for marine auxiliary and land service (excluding carburettor type). (Price 2/-, post free.)
I.P.E. Representative on appropriate B.S.I. Committee : Mr. J. E. Baty.

1574 : 1949 Split cotter pins. (Price 2/-, post free.)
I.P.E. Representative on appropriate B.S.I. Committee : Mr. J. E. Baty.

1553 : Part I : 1949 Graphical symbols for pipes and valves. (Price 2/-, post free.)
I.P.E. Representative on appropriate B.S.I. Committee : Mr. J. E. Baty.

STANDARDS INDEX Members who have not already done so, are asked if they would kindly complete and return the Standards Index Card as soon as possible, in order that our records may be brought up to date.

BOOKS RECEIVED "A Fair Day's Pay," by J. J. Gracie. Management Publications Trust, Ltd. Price 10/6 net.

"Testing Machine Tools," by Dr. George Schlesinger. Machinery Publishing Co. Ltd., Brighton. Price 17/6 net.

Among recent books received is a copy of the newly issued 5th edition of the late Georg Schlesinger's book, "Testing Machine Tools." This new edition, as well as containing the material established by the original work, has been brought up to date and new work included, consisting of a chapter dealing with Acceptance Tests for woodworking machinery. A.L.S.

ISSUE OF JOURNAL TO NEW MEMBERS Owing to the fact that output has to be adjusted to meet requirements, and in order to avoid carrying heavy stocks, it has been decided that the Journal will only be issued to new Members from the date they join the Institution.

IMPORTANT In order that the Journal may be despatched on time, it is essential that copy should reach the Head Office of the Institution not later than 40 days prior to the date of issue, which is the first of each month.

SECTION MEETINGS

The following meetings have been arranged to take place in January and February. Where full details are not given, these have not been received at the time of going to press.

January

2nd YORKSHIRE SECTION. A lecture on "Modern Measuring and Inspection Equipment and Its Application" will be given by Mr. E. Clarke, at the Hotel Metropole, King Street, Leeds, 1, at 7-00 p.m.

4th NOTTINGHAM SECTION. A lecture on "Noise and Vibration in Machinery," to be illustrated by slides, will be given by Dr. W. A. Tuplin, D.Sc., M.I.Mech.E., at the Victoria Station Hotel, Milton Street, Nottingham, at 7-00 p.m.

4th WOLVERHAMPTON SECTION. A lecture on "Mechanical Mishaps and Their Relation to Design and Workmanship" will be given by Mr. G. E. Windeler, M.C.E., M.I.Mech.E., M.I.Mar.E., at the West Midland Gas Board Demonstration Room, Clarence Street, Wolverhampton, at 7-00 p.m.

5th GLASGOW SECTION. An Informal Discussion on "Metal Cutting," led by Mr. G. V. Stabler, will be held at the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, C.2, at 8-00 p.m.

6th WEST WALES SUB-SECTION. A lecture on "The Production Engineer—His Education and Training," will be given by Mr. T. B. Worth, M.I.Mech.E., M.I.P.E., A.M.I.E.E., in the Civic Buildings, Swansea, at 7-30 p.m.

7th YORKSHIRE GRADUATE SECTION. A visit has been arranged to the Yorkshire Copper Works, Ltd., Stourton, Leeds, 10, commencing at 2-15 p.m.

9th SHEFFIELD SECTION. A lecture on "Education of a Production Engineer" will be given by Dr. H. Schofield, C.B.E., M.I.P.E., at the Royal Victoria Station Hotel, Sheffield, at 6.30 p.m.

10th BIRMINGHAM GRADUATE SECTION. A lecture on "Production Managements Responsibility for Productivity" will be given by Mr. B. H. Dyson, M.I.P.E., F.I.I.A., at the James Watt Memorial Institute, Great Charles Street, Birmingham, 3. at 7-00 p.m.

January—*cont.*

10th WOLVERHAMPTON GRADUATE SECTION. A lecture on " Planning " will be given at the West Midland Gas Board Demonstration Room, Darlington Street, Wolverhampton, at 7-15 p.m.

11th PRESTON SECTION. A lecture on " Payment by Results " will be given by Mr. A. J. Charnock, M.I.P.E., at the Harris Institute, Corporation Street, Preston, at 7-15 p.m.

11th WESTERN SECTION. A lecture on " Incentives for Production " will be given by Mr. C. L. Taylor, A.M.I.P.E., at the College, Swindon, at 7-30 p.m.

12th HALIFAX GRADUATE SECTION. A lecture on " Metal Spraying " will be given by Mr. W. Wall, at the Halifax Municipal Technical College, Halifax, at 7-00 p.m.

13th COVENTRY SECTION. A lecture on " Factory Administration from the Accountants' Viewpoint " will be given by Mr. E. A. Hyde, A.I.P.E., at the Greyfriars Rooms, The Geisha Cafe, Hertford Street, Coventry, at 7-00 p.m.

13th EASTERN COUNTIES SECTION. A lecture on " Industrial Applications of the Lost Wax Process " will be given by Mr. A. Short, A.M.I.P.E., in the Lecture Hall, Electric House, Ipswich, at 7-30 p.m.

16th DERBY SUB-SECTION. A lecture on " Modern Milling Practice " will be given by Mr. W. S. B. Kidd, at the School of Art, Green Lane, Derby, at 7-00 p.m.

17th DUNDEE SECTION. A lecture on " British Management at the Cross Roads " will be given by Mr. Lewis C. Ord, at Mathers Hotel, Whitehall Crescent, Dundee, at 7.15 p.m.

17th MANCHESTER GRADUATE SECTION. A lecture on " Recent Improvements in Production Methods " will be given by the Section Chairman, Mr. R. Cleary, Grad.I.P.E., G.I.Mech.E., in the Reynolds Hall, College of Technology, Manchester, at 7-15 p.m.

18th BIRMINGHAM SECTION. A lecture on " The Nature and Economics of the Machine Tool Industry " will be given by Messrs. W. V. Hodgson, M.I.P.E., and E. A. Hyde, A.I.P.E., at the James Watt Memorial Institute, Great Charles Street, Birmingham, 3, at 7-00 p.m.

January—*cont.*

18th EDINBURGH SECTION. A lecture on " Education for Management " will be given by Lt.-Col. L. Urwick, O.B.E., M.C., M.A., M.I.P.E., C.I.Mech.E., F.I.I.A., at the North British Station Hotel, Edinburgh, at 7.30 p.m. This is a joint meeting with the East of Scotland Branch of the Institute of Personnel Management.

18th LIVERPOOL SECTION. A lecture on " Valid Incentives " will be given by Mr. E. C. Gordon England, M.I.P.E., F.I.N.I., F.R.Ae.S., F.I.I.A., at Radiant House, Bold Street, Liverpool, at 7-15 p.m.

18th LUTON GRADUATE SECTION. A lecture on " Modern Adhesives " will be given by Mr. T. C. Ford, Stud.I.P.E., in the Small Assembly Room, Town Hall, Luton, at 7-30 p.m.

18th MANCHESTER SECTION. A lecture on " Effective Use of Materials " will be given by Mr. R. F. Archer, at the Mechanics Institute, Crewe, at 7-15 p.m.

18th NORTHERN IRELAND SECTION. A lecture on " Material Handling " will be given by Mr. Hartford M. King, at the Municipal College of Technology, Belfast, at 7-00 p.m.

18th WESTERN SECTION. A lecture on " Production and Inspection on Gears " will be given by Mr. J. Milwain, M.I.P.E., M.I.E.I., at the Grand Hotel, Bristol, at 7-15 p.m.

19th GLASGOW SECTION. A lecture on " Apprentice Training " will be given by Mr. C. A. Packer, A.M.I.Mech.E., at the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, C.2, at 7-30 p.m.

19th LEICESTER AND DISTRICT SECTION. A lecture on " Metals in the Service of Man " will be given by Dr. W. O. Alexander, at the Leicester College of Technology, Room 104, The Newarke, Leicester, at 7-00 p.m.

19th LONDON SECTION. A lecture on " The Relation Between Technical Education, Training and Production " will be given by Messrs. T. W. Price, M.I.P.E., A.I.I.A., and T. B. Worth, M.I.Mech.E., M.I.P.E., A.M.I.E.E., at the Royal Empire Society, Northumberland Avenue, London, W.C.2, at 7-00 p.m.

January—*cont.*

20th NORTH EASTERN GRADUATE SECTION. An Address will be given by the President of the Senior Section, Mr. L. Walker, M.I.P.E., in the Neville Hall Mining Institution, Westgate Road, Newcastle-upon-Tyne, 1, at 7-00 p.m.

21st YORKSHIRE GRADUATE SECTION. A lecture on " History and Developments of the Diesel Engine " will be given by Mr. J. Whitaker, at the Great Northern Station Hotel, Leeds, 1, at 2.30 p.m.

23rd COVENTRY GRADUATE SECTION. A lecture on " Die Casting " will be given by Mr. Robinson, in the Greyfriars Rooms, Geisha Cafe, Hertford Street, Coventry, at 7.15 p.m.

23rd HALIFAX SECTION. A lecture on " Production Management Problems " will be given by Mr. M. Seaman, M.Sc., M.I.Mech.E., M.I.P.E., A.M.I.E.E., at Whiteley's Cafe, Westgate, Huddersfield, at 7-00 p.m. This is a joint meeting with the " D.B.T." Engineering Society.

25th SHREWSBURY SUB-SECTION. A lecture on " Modern Die Forging Practice " will be given at the Walker Technical College, Oakengates, at 7-30 p.m.

25th SOUTH WALES AND MONMOUTHSHIRE SECTION. A lecture on " Starting a New Factory " will be given by Mr. A. R. Northover, A.M.I.P.E., at the South Wales Institute of Engineers, Park Place, Cardiff, at 6-45 p.m.

27th LIVERPOOL SECTION. A Ladies' Night will be held at Reeces Restaurant, Parker Street, Liverpool.

27th LONDON GRADUATE SECTION. A lecture on " Factors Which Govern Productivity " will be given by Mr. Ian Mikardo, M.P., at the Institution of Production Engineers, 36, Portman Square, London, W.1, at 7-15 p.m.

30th MANCHESTER SECTION. A lecture on " Measurement of Productive Efficiency " will be given by Mr. W. C. Puckey, M.I.P.E., F.I.I.A., at the College of Technology, Sackville Street, Manchester, at 7-15 p.m.

30th NORTH EASTERN SECTION. A lecture on " Protective Finishes " will be given by Mr. A. Messenger, in the Neville Hall Mining Institution, Westgate Road, Newcastle-upon-Tyne, 1, at 7-00 p.m.

January—*cont.*

31st LINCOLN SUB-SECTION. A lecture will be given by Mr. S. Richards at Messrs. Ruston & Hornsby's Canteen, Anchor Street Works, Lincoln, at 7-15 p.m.

31st LUTON, BEDFORD AND DISTRICT SECTION. A lecture on "Electronics in Industry" will be given by Mr. J. S. Sargrove, in the Small Assembly Room, Town Hall, Luton, at 7-00 p.m.

February

1st NOTTINGHAM SECTION. A lecture on "Joint Consultation," to be illustrated by a sound film, will be given by Mr. F. E. Maer, M.I.P.E., at the Victoria Station Hotel, Milton Street, Nottingham, at 7-00 p.m.

1st PRESTON SECTION. A lecture on "Corrosion of Metals" will be given by Mr. W. Murray, A.M.C.I., F.R.I.C., F.C.S., M.Inst.F., at Clayton, Goodfellow & Co., Ltd., Atlas Iron Works, Park Road, Blackburn, at 7-15 p.m.

1st WOLVERHAMPTON SECTION. A lecture on "Drop Forgings, Production Practice and Application" will be given by Mr. R. P. Brookes, at the Dudley and Staffordshire Technical College, Dudley, at 7-00 p.m.

3rd BIRMINGHAM SECTION. A lecture on "Productivity and Costs" will be given by Mr. W. S. Risk, B.Comm.(Edin.), C.A., F.C.W.A., at the Chamber of Commerce, 95, New Street, Birmingham, at 6-30 p.m. This will be a Joint Meeting with the Birmingham Branch of the Institute of Cost and Works Accountants.

3rd WEST WALES SUB-SECTION. A lecture on "The Metallurgist's Place in Production Engineering" will be given by Mr. E. R. Gadd, F.I.M., at the Y.M.C.A., St. Helen's Road, Swansea, at 7-30 p.m.

4th YORKSHIRE GRADUATE SECTION. A visit has been arranged to the Hunslet Engine Co., Ltd., Hunslet Engine Works, Jack Lane, Leeds, 10, commencing at 2-15 p.m.

6th HALIFAX SECTION. A lecture on "The History and Development of the Automatic Loom" will be given by Mr. H. de G. Gaudin, B.A., M.I.Mech.E., at the White Swan Hotel, Halifax, at 7-15 p.m.

February—*cont.*

6th YORKSHIRE SECTION. A lecture on "Industrial Finishes" will be given by Messrs. C. F. Hennessey and C. C. Gladwell, at the Hotel Metropole, King Street, Leeds, 1, at 7-00 p.m. This will be followed by a film entitled "The Technique of Spray Painting."

7th WOLVERHAMPTON GRADUATE SECTION. A lecture on "Resistance Welding" will be given by Mr. C. E. Slade, M.Inst.W., at the Dudley and Staffordshire Technical College, Dudley, at 7-15 p.m.

8th MANCHESTER GRADUATE SECTION. A lecture on "Surface Coating and Synthetic Finishes" will be given by Mr. W. Howard, A.M.I.Mech.E., in the Reynolds Hall, College of Technology, Manchester, at 7-15 p.m.

9th CORNWALL SECTION. A lecture on "Diesel Engine Development" will be given by Mr. Freeman Sanders, M.I.A.E., at Holman's Canteen, Dolcoath Road, Camborne, at 7-15 p.m.

10th COVENTRY SECTION. A lecture on "Modern Developments in Measurement Including Screw Threads" will be given by Mr. W. H. Foster, A.M.I.P.E., M.I.E.I., at the Greyfriars Rooms, The Geisha Cafe, Hertford Street, Coventry, at 7-00 p.m.

10th EASTERN COUNTIES SECTION. A lecture on "Motion Study" will be given by Miss A. G. Shaw, M.A., M.I.P.E., in the Lecture Hall, Electric House, Ipswich, at 7-30 p.m.

10th WESTERN SECTION. A lecture on "Electronics in Industry" will be given by Mr. L. G. Ward, B.Sc., at the Wheatstone Hall, Brunswick Road, Gloucester, at 7-30 p.m.

11th BIRMINGHAM. The Senior and Graduate Sections will hold a joint Buffet Dance at the Botanical Gardens, Edgbaston.

13th SHEFFIELD SECTION. A lecture on "Ball and Roller Bearing Manufacture" will be given by Mr. R. K. Allan, M.I.P.E., A.M.I.Mech.E., at the Royal Victoria Station Hotel, Sheffield, at 6-30 p.m.

14th BIRMINGHAM GRADUATE SECTION. A "Brains Trust" has been arranged, when questions will be answered by leading Industrialists, at the James Watt Memorial Institute, Great Charles Street, Birmingham, 3, at 7-00 p.m.

February—*cont.*

14th DUNDEE SECTION. A lecture on " Air Operated Fixtures " will be given by Mr. C. M. P. Willcox, at Mathers Hotel, Whitehall Crescent, Dundee, at 7-15 p.m.

15th BIRMINGHAM SECTION. A lecture on " Automatic Bar Machines and Their Application from the Users' Point of View " will be given by Mr. A. W. Nye, at the James Watt Memorial Institute, Great Charles Street, Birmingham, 3, at 7-00 p.m.

15th EDINBURGH SECTION. A lecture on " Air Operated Fixtures " will be given by Mr. N. P. Watts, at the North British Station Hotel, Edinburgh, at 7-30 p.m.

15th LIVERPOOL SECTION. A lecture on " Costing as an Aid to Management " will be given by Mr. H. H. Norcross, A.I.P.E., F.C.W.A., F.I.I.A., at Radiant House, Bold Street, Liverpool, at 7-15 p.m. This is a joint meeting with the Institute of Cost and Works Accountants, the Institute of Industrial Administration, and the Institute of Office Management.

15th LONDON GRADUATE SECTION. A visit has been arranged to the Glacier Metal Company Ltd., Alperton, Wembley, Middlesex, commencing at 2-30 p.m.

15th LUTON GRADUATE SECTION. A lecture on " Photography in Industry " will be given by Mr. G. A. Jones, M.A., A.R.I.C., F.R.P.S., in the Small Assembly Room, Town Hall, Luton, at 7-30 p.m.

15th WESTERN SECTION. A lecture on " Activities of the Production Engineering Research Association " will be given by Dr. D. F. Galloway, B.Sc. (Hons.), M.I.P.E., at the Grand Hotel, Bristol, at 7-15 p.m.

16th GLASGOW SECTION. A lecture on " Precision Casting " will be given by Dr. F. M. Hudson, F.I.M., at the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, C.2, at 7-30 p.m.

16th LONDON SECTION. A lecture on " Works Organisation for Large Scale Research and Development of Aircraft Engines " will be given by Mr. J. S. Paget, B.A. (Cantab.), A.M.I.Mech.E., M.I.P.E., at the Royal Empire Society, Northumberland Avenue, London, W.C.2, at 7-00 p.m.

February—*cont.*

17th LONDON GRADUATE SECTION. A lecture on "Valid Incentives" will be given by Mr. E. C. Gordon England, M.I.P.E., F.I.N.A., F.R.Ae.S., F.I.I.A., at the Institution of Production Engineers, 36, Portman Square, London, W.1, at 7-15 p.m.

17th NORTH EASTERN GRADUATE SECTION. A film show has been arranged, when "Through the Mill," "The Tube Age," and "Pluto Job 99" will be shown, in the Neville Hall Mining Institution, Westgate Road, Newcastle-upon-Tyne, 1, at 7-00 p.m.

18th YORKSHIRE GRADUATE SECTION. A lecture on "Photo-Elasticity for Engineers" will be given by Mr. J. Ward, B.Sc., Ph.D. (London), M.I.Mech.E., M.I.Mar.E., at the Great Northern Station Hotel, Leeds, 1, at 2-30 p.m. This lecture will be illustrated by lantern slides and a display of models and photographs.

20th DERBY SUB-SECTION. A lecture on "Arc Welding" will be given at the School of Art, Green Lane, Derby, at 7-00 p.m.

20th NORTH EASTERN SECTION. A lecture on "The Human Factor in Productivity" will be given by Dr. Elliot Jacques, M.D., in the Neville Hall Mining Institution, Westgate Road, Newcastle-upon-Tyne, 1, at 7-00 p.m.

22nd NORTHERN IRELAND SECTION. A lecture on "The Education of the Production Engineer" will be given by Mr. T. B. Worth, M.I.P.E., M.I.Mech.E., A.M.I.E.E., at the Municipal College of Technology, Belfast, at 7-00 p.m.

22nd SHREWSBURY SUB-SECTION. A lecture on "Modern Milling Practice" will be given by Mr. W. S. B. Kidd, at the Technical College, Shrewsbury, at 7-30 p.m.

22nd SOUTH WALES AND MONMOUTHSHIRE SECTION. A lecture on "Precision Castings for General Engineering Purposes" will be given by Dr. F. Hudson, at the South Wales Institute of Engineers, Park Place, Cardiff, at 6-45 p.m.

23rd LEICESTER AND DISTRICT SECTION. Three Papers will be read by Section Members, followed by a discussion, at the Leicester College of Technology, Room 104, The Newarke, Leicester, at 7-00 p.m.

February—*cont.*

23rd LUTON GRADUATE SECTION. A visit has been arranged to the Wealdstone Works, Kodak Ltd., Harrow, Middlesex. Further information may be obtained from the Section Honorary Secretary.

23rd BIRMINGHAM GRADUATE SECTION. An afternoon visit has been arranged to Hams Hall, " B " Power Station, Lea Marston, Minworth, Birmingham.

25th HALIFAX GRADUATE SECTION. A lecture on " Noise and Vibration in Machinery " will be given by Dr. W. A. Tuplin, D.Sc., M.I.Mech.E., at the White Swan Hotel, Halifax. The Annual General Meeting will be held at 2-00 p.m., and will be followed by the above lecture at 2-30 p.m.

27th MANCHESTER SECTION. A lecture on " Advance of Industrial Heat Treatment " will be given by Mr. J. McHenry, A.M.I.F., A.M.I.T., at the College of Technology, Sackville Street, Manchester, at 7-15 p.m.

28th LINCOLN SUB-SECTION. An evening visit has been arranged to the works of Rose Bros. (Gainsborough) Ltd., Gainsborough, commencing at 7-00 p.m.

28th LUTON, BEDFORD AND DISTRICT SECTION. A documentary film on " Mechanical Handling " will be shown in the Small Assembly Room, Town Hall, Luton, at 7-00 p.m.

THE INSTITUTION OF
OF PRODUCTION ENGINEERS

Notice of
ANNUAL GENERAL MEETING

Notice is hereby given that the Annual General Meeting of the Institution will be held on Thursday, January 26th, 1950, at the Institution's Headquarters, 36, Portman Square, London, W.1, at 4 p.m.

Agenda

1. Notice convening Meeting.
2. Minutes of previous Annual General Meeting.
3. Report on Election of Members of Council.
4. Annual Report of the Council.
5. Presentation of Statement of Income and Expenditure, and Balance Sheet, and Auditors' Report.
6. Adoption of Amendments to Articles of Association as circulated herewith.
7. Election of Auditors, 1949-50.
8. Election of Solicitors, 1949-50.
9. Votes of Thanks.

By order of the Council,
C. B. THORNE, Director and General Secretary.

BALANCE SHEET

and Income Expenditure Account for the Year ended 30th June, 1949

THE INSTITUTION OF

BALANCE SHEET

1948					
	ACCUMULATED FUNDS AND SURPLUS	£ s. d.	£ s. d.		
£				£	s. d.
24,428	The Viscount Nuffield Gift	24,428 19 8			
100	The Lord Austin Prize Fund	100 0 0			
100	The Hutchinson Memorial Fund	100 0 0			
				24,628	19 8
1,272	Leasehold Premises Sinking Fund	1,398 16 8			
700	Dilapidations Reserve Fund	800 0 0			
				2,198	16 8
47	Life Subscriptions: *less* amount transferred to Income and Expenditure Account			387	9 1
	Income and Expenditure Account:				
	Balance as at July 1st, 1948	13,645 15 11			
13,646	*Less* Excess of Expenditure over Income for the year ...	7,533 15 7			
				6,112	0 4
				33,327	5 1
783	Hazleton Library Memorial	705 5 9			
—	Schofield Scholarship	205 0 0			
				910	5 9
	CURRENT LIABILITIES				
2,237	Sundry Creditors	942 14 11			
170	Subscriptions Received in Advance	399 4 10			
820	Structural Repairs Account	1,000 0 0			
196	Furniture and Equipment Account				
	Bank Overdraft 7,262 18 4				
	Less Balances in hand on Petty Cash and Sections accounts 2,094 19 6				
		5,167 18 10			
				7,509	18 10
	Note.—There is a contingent liability in respect of the completion of structural repairs at 36, Portman Square, and in respect of certain pending legal proceedings.				
£44,499				£41,747	10 5

HERBERT SCHOFIELD, *President.*
J. E. HILL, *Chairman of Council and Finance Committee.*
C. B. THORNE, *Director and General Secretary.*

INCOME and EXPENDITURE ACCOUNT for the year

1948			
£		£	s.
10,547	To Salaries	12,559	18
673	„ Rent, Light, Heating and Cleaning	1,204	11
2,086	„ Section Expenses	2,583	2
3,538	„ Printing, Postages, Stationery and Telephone	5,237	9
8,456	„ Cost of Journal	10,712	10
1,484	„ Travelling and Expenses of Meetings other than Section Meetings ...	1,827	4
142	„ Audit Fee	157	10
50	„ Professional Charges and Insurance	299	3
112	„ Donations and Grants	111	5
284	„ Repairs and Renewals	607	11
—	„ National Convention, 1948—Administrative Cost	352	5
—	„ „ „ „ Part cost of Special Journal	600	0
361	„ Miscellaneous	232	7
127	„ Transfer to Leasehold Premises Sinking Fund	127	3
100	„ „ „ Dilapidations Reserve Fund	100	0
—	„ „ „ Structural Repairs Account	308	15
—	„ Amount written off Furniture, Fixtures and Plant	6	11
44	„ Loss on Sale of Investments		
£28,004		£37,027	9

PRODUCTION ENGINEERS

as at 30th June, 1949

1948		£ s. d.	£ s. d.
	FIXED ASSETS		
£ 3,481	LEASEHOLD PREMISES at cost ... ... (Depreciation is provided by a Sinking Fund)		3,481 0 0
	FURNITURE, FITTINGS AND PLANT at the net amount standing in the Institution's books at June 30th, 1948	1,530 19 3	
	Additions during year	2,373 7 8	
		3,904 6 11	
1,475	*Less* Depreciation—Overseas Sub-Councils only	6 11 6	
			3,897 15 5
24,629	FUND INVESTMENTS at cost : as scheduled ... ... (Market Value, £24,951)		24,628 19 8
1,972	SINKING FUND POLICIES : as scheduled ... ... (Premiums Paid)		2,198 16 8
			34,206 11 9
	CURRENT ASSETS		
3,567	SUNDRY DEBTORS, DEPOSITS AND STOCKS	4,058 8 3	
4,000	PRODUCTION ENGINEERING RESEARCH ASSOCIATION OF GREAT BRITAIN	2,000 0 0	
4,002	GENERAL INVESTMENTS at cost : as scheduled ... ... (Market Value, £1,093)	1,132 10 0	
100	UNITED BUILDING SOCIETY DEPOSIT (South Africa)	350 0 0	
1,273	CASH : At Bank and In Hand		
			7,540 18 3
£44,499			£41,747 10 0

REPORT OF THE AUDITORS TO THE MEMBERS OF THE INSTITUTION OF PRODUCTION ENGINEERS :

We have obtained all the information and explanations which, to the best of our knowledge and belief were necessary for the purposes of our audit. In our opinion proper books of account have been kept by the Institution so far as appears from our examination of those books. Audited Balance Sheets and Accounts have been received from the South African and Australian Sub-Councils. Both these Accounts have been incorporated in the above Balance Sheet and annexed Income and Expenditure Account. We have examined the above Balance Sheet and annexed Income and Expenditure Account which are in agreement with the books of account audited by us and the audited Sub-Councils Accounts supplied to us. In our opinion and to the best of our information and according to the explanations given us the said accounts give the information required by the Companies Act, 1948, in the manner so required and the Balance Sheet gives a true and fair view of the state of the Institution's affairs as at 30th June, 1949, and the Income and Expenditure Account gives a true and fair view of the excess of expenditure over income for the year ended on that date.

Aldwych House,
London, W.C.2.
17th October, 1949.

GIBSON, APPLEBY & CO.,
Auditors,
Chartered Accountants.

ended 30th June, 1949 (including Overseas Sections)

1948		£ s. d.	£ s. d.
£	By Subscriptions Received—		
17,370	Current	19,226 14 10	
360	Arrears	288 6 3	
			19,515 1 1
1,166	„ Interest on Investments		1,006 6 0
6,100	„ Journal Receipts...		8,653 5 11
276	„ Sale of Publications		258 16 4
—	„ Profit on Sale of Investments		60 4 10
1,401	„ War Damage Refund		—
1,231	„ Balance being Excess of Expenditure over Income		7,533 15 7
£28,004			£37,027 9 9

INVESTMENTS, 30th JUNE, 1949

	£ s. d.	£ s. d.
Schedule of Fund Investments.		
The Viscount Nuffield Gift :		
£7,124 19 10 3½% War Stock	7,428 19 8	
£8,389 9 6 3% National Defence Stock, 1954/58	8,000 0 0	
£9,038 0 0 4% Canadian Pacific Railway Perpetual Consolidated Debenture Stock	9,000 0 0	
		24,428 19 8
The Lord Austin Prize Fund :		
£95 8 5 3½% War Stock		100 0 0
Hutchinson Memorial Fund :		
£95 8 5 3½% War Stock		100 0 0
		£24,628 19 8
Schedule of General Investments (Unallocated).		
£274 12 0 3½% War Stock		290 0 0
£148 3 11 3½% War Stock		150 0 0
£382 13 8 3½% War Stock		400 0 0
£190 16 11 3½% War Stock		200 0 0
£37 17 3 3½% War Stock		40 0 0
£50 2 6 3½% War Stock		52 10 8
Total as per Balance Sheet		£1,132 10 0
Schedule of Sinking Fund Policies.		
Leasehold Premises Sinking Fund :		
Norwich Union Life Insurance Society Policy—Premium Paid ...		1,398 16 8
Dilapidations Reserve Fund :		
General Accident Fire & Life Assurance Corporation Ltd. Policy—Premium Paid		800 0 0
		£2,198 16 8

Articles of Association

Proposed Amendments to be submitted to the Annual General Meeting on Thursday, January 26th. 1950.

Article No.	*Amendment*
2	Line 2—delete " is " and substitute " was."
5	Line 1—delete " after."
7	Line 3—delete " person who " and substitute " persons as."
9	Delete " I.P.E." where quoted and substitute in each case " I.Prod.E."
10	Line 1—between " member " and " on " insert " (except Students)."
13	Para. (*c*), lines 2 and 3—delete " by exemption " and substitute " been exempted."
16	Line 1—between " an " and " industrial " insert " incorporated." Line 3—add " and approved by resolution of Council as an affiliated organisation." Line 5—between " persons " and " as " insert " approved by Council."
28	At end of Article add : " The provisions of Article 27 shall *mutatis mutandis* apply to a removal under this Article."
38	Line 1—change " become " to " becomes." At end of Article add : ", or if he ceases to hold office by virtue of Section 185 of the Act or by a resolution passed pursuant to Section 184 of the Act or becomes prohibited from acting by any order made under Section 188 of the Act."
39	Line 3—delete " not less than " and substitute " (unless and until otherwise determined by Council)."
40	Lines 19 and 20—delete " each or."
45	Line 4—between " appointment " and " of " insert " or continuance in office." At end of Article add : " and had continued in office and been qualified."
46	Line 2—between " of " and " Council " insert " a resolution of." Line 4—delete " Director & General." Line 6—delete " Director & General."
49	Heading—delete " Director & General." Line 1—delete " Director & General." Line 4—delete " Director & General."
53	Line 2—between " called " and " annual " insert " the." At end of first sentence—add : " and shall be specified as such in the notice convening it."
54	Lines 1 and 2—delete " in London or." Line 2—delete " at a time and place " and substitute " and at such time." Line 5—before " 31st " insert " the." Line 5—between " the " and " preceding " insert " end of the." At end of Article—add : " or after a greater interval than fifteen months after the last preceding Annual General Meeting."

Article No.	*Amendment*
56	At beginning of Article—add : " Subject as hereinafter provided."
57	Lines 1 and 2—delete from " subject " to " resolutions." Line 2—between " notice " and " of " insert " in writing." Line 3—between " -ing " and " specifying " insert " (exclusive both of the day on which the notice is given or deemed to be given and of the day fixed for the meeting)." At end of line 3—after " the " insert " general." Lines 4 and 5—delete " at any General Meeting " and substitute " thereat." Line 5—between " to " and " every " insert " the Auditors and to." Line 6—between " and " and " no " insert " (subject to Section 140 of the Act)." Line 8—delete " send " and substitute " give." Line 9—delete " member " and substitute " person entitled to receive the same." Line 10—between " business " and " transacted " insert " to be."
61	Line 4—delete " and " and substitute " or." At end of Article—add : " All votes to be given personally, and proxies shall not be allowed."
62	Line 3—after " present " add " and entitled to vote." Line 4—between " before " and " the " insert " or on."
73	Lines 1 and 2—delete " Director and General."
76	At end of Article—add : ", and shall be sent to each member as and when published."
78	Line 1—between " proper " and " books " insert " and sufficient."
79	Line 2—between " or " and " at " insert " (subject to Section 147 (3) of the Act)."
81	Line 1—delete " lay " and substitute " in accordance with Sections 148, 150 and 157 of the Act, cause to be prepared and to be laid." Line 5—after " such " insert " account." Line 6—between " reports " and " shall " insert " and of all other documents (if any) required by the Act to be annexed or attached thereto or to accompany the same." Last line—delete " 155 " and substitute " 162."
82	(*New Article*) : DISSOLUTION " Clause 9 of the Memorandum of Association of the Institution relating to the Winding Up and Dissolution thereof shall have effect as if the provisions of that Clause were repeated herein."

ELECTION OF MEMBERS

Meeting of Council, 20th October, 1949

The following were elected to membership by Council :—

As Members :

J. Baker, L. F. Broad, S. R. Cauthery, P. L. Crabtree, I. E. Good, S. S. Lal, A. T. Lindley, H. W. Mander, G. G. Patman, T. R. Patterson, A. Scrivener, E. Slater, J. A. Smith, J. E. L. Strevens, W. Symes, E. T. Wakefield.

As Associate Members :

F. N. Allchin, C. Allen, V. J. Bailey, S. K. Banerjee, G. Beacham, G. F. Blurton, W. H. Boocock, E. R. Bootles, C. G. Bornhag, H. W. Bramwell, W. Bretter, H. W. Brayshaw, E. H. Brown, A. Buckley, C. W. Cock, A. D. Copland, H. Corthorn, H. Crowther, W. Cunliffe, W. H. Curtis, A. A. Daultrey, H. H. Davies, D. S. Denyan, J. H. Dwyer, S. E. Evans, J. B. Findlay, F. Garlick, C. F. Harris, A. R. Hartley, J. F. Heward, W. M. Hiorns, C. Houghton, T. I'Anson, M. L. Jain, K. C. Jaitly, H. R. Jevon, A. R. Johnson, J. E. Keal, F. R. Kelly, D. C. Ling, P. Lloyd-Jones, J. N. MacGregor, M. N. Maity, D. Marsden, A. E. Maver, R. Mead, J. R. Moore, J. Neill, J. E. Noble, T. R. J. Oakley, R. Oscroft, R. S. Parks, C. J. Pearce, W. B. Pearson, J. H. Place, K. H. Platt, H. J. Rose, B. O. Raymond, E. F. W. Sayers, F. Scammell, L. Shepherd, K. G. Slorach, J. H. Spurr, E. J. Stewart, A. D. P. Tallents, A. W. Taylor, T. D. Turner, P. E. Verrall, F. H. J. Vincent, V. S. White, J. G. Williams, N. C. Williams, J. C. Wood, E. D. Woolley, E. Zagni.

As Associates :

E. V. Elliott, A. J. H. Hunt, S. Jessop, H. Thompson.

As Graduates :

J. Alldrick, M. Ashworth, D. E. Banham, N. K. Barooah, N. E. Cornish, W. Elliott, D. G. Finikin, J. A. Finney, J. Fray, P. M. Goodchild, E. R. Higham, R. A. Hinkley, T. E. Hines, F. M. Jones, R. N. Kashyap, T. P. Keenan, S. Lambert, E. P. Lawler, S. B. Majumdar, J. McCluskey, A. A. McPherson, K. W. Metcalfe, D. G. Mickleburgh, I. Mokerjea, H. W. Morgan, K. L. Pickett, L. J. Saunders, N. W. Taylor, P. G. Thacker, F. Williams, M. Withers, D. F. Wortham.

As Students :

A. J. Baillie, G. T. A. Blakey, M. Clewley, D. G. Coleman, W. R. Coleman, K. J. A. Cremona, D. T. Dawson, D. E. Furnis, D. Hackett, T. W. Harman, D. G. Iles, W. A. Keightley, K. Knott, D. Laxton, G. P. Mankin, I. G. Marsh, P. W. Morris, M. G. Phelan, G. D. Phillips, G. P. Philpott, P. R. Rao, P. Sharp, J. A. Stafford, J. E. A. Tuck.

	Additional Affiliate Representative :
Affiliated Firms :	
Birlec Limited	N. G. Gillard.
	Change of Affiliate Representatives :
The Carburundum Co., Ltd.	R. G. Snelgrove
Fletcher Miller, Ltd.	A. E. Lawson
New Affiliated Firm :	Affiliate Representatives :
The Park Gate Iron & Steel Co., Ltd....	J. Wadsworth.
	H. Foster.

Reinstatement as Member :
R. D. Ewart.

Transfers :

From Associate Member to Member :
J. A. Bailey, R. L. Kapoor, G. J. Mathys, S. L. Moon, A. R. Northover, S. A. J. Parsons.

From Associate to Member :
G. R. Galla-More.

From Intermediate Associate Member to Member :
E. L. Tuff.

From Intermediate Associate Member to Associate Member :
V. J. Adams, J. Addy, T. H. Allen, G. H. Allwood, N. L. Anderson, W. T. Anderson, D. G. Ansell, F. W. J. Appleton, K. Archer, A. W. Arthurs, J. H. Arundel, S. G. Atkinson, R. W. Austin, R. Avery, R. J. Bailey, R. G. Baker, F. C. Bambridge, E. H. Banister, P. A. Barber, S. G. Barbet, F. G. Barker, J. S. Barker, F. J. Barlow, E. J. Barnes, W. Bartle, W. Barton, P. Basu, S. Bateman, F. W. Bates, W. J. Baxter, A. E. Bayly, S. F. Beckett, G. Bell, L. Bell, N. F. Bell, H. R. Benner, P. Bentley, H. E. Bew, P. C. Biddle, R. E. Bird, G. Blachford, N. R. Blackburn, H. S. Boards, A. Bold, J. Bolwell, W. Bone, J. E. Booth, G. S. Boothroyd, A. Bourne, P. S. Boutell, F. A. Bowen, C. T. Bower, F. Boydon, N. J. Brader, E. A. Bradley, W. J. Bramley, N. F. Bratt, A. E. Brook, W. Brookes, F. Brown, L. G. Brown, R. J. W. Brown, W. Brown, A. W. Bryant, W. F. Bryant, M. A. Bull, C. M. Burgess, H. L. J. Burgess, J. Burns, T. E. Burr, E. J. Burrell, J. W. Burrows, R. H. Burt, R. H. Burton. E. W. Butler, W. Butler, W. A. Butler, T. Caddick, D. Caie, A. Calderbank, A. H. Cameron, C. Cantrell, A. J. Carder, G. A. Carter, L. G. Carver, E. R. Cash, R. Cashmore, R. V. Castell-Evans, W. Castledine, J. W. Challenor, W. E. Challinor, S. N. Chatterjee, T. H. Christy, H. Citner, C. L. Clarke, M. Clarke, T. J. Clarke, J. S. Cochrane, W. H. Cole, P. Colley, E. M. J. Concannon, J. W. Connor, F. J. Cook, P. H. Cook, W. A. Cook, J. F. Cooper, R. E. Copelin, H. B. Copley, G. G. Coppola, C. A. Cordwell, G. H. I. Cornwell, W. G. J. Cowan, M. J. Cowell, C. Craven, F. W. Craythorne, F. G. Cresswell, J. H. Cribb, H. J. Critchley, C. R. Croucher, C. G. Crowley, A. Crowther, F. R. Culley, C. F. Cunningham, D. C. Curwen, H. H. Cushing, W. S. Cuthbertson, R. N. Das, H. David, F. G. Davies, G. W. Davies, R. Davis, G. V. Dawbarn, S. J. Dawson, G. H. Dean, H. Dean, H. L. Dean, E. P. Dedman, L. de Gebert, T. Devine, I. K. Dewar, L. Dexter, J. Dickson, A. E. Diment, H. J. Diment, A. T. Dinham, H. Dodd, W. Dodgson, G. W. Donovan, R. G. Douthwaite, G. L. A. Draper, J. W. Duffield, S. E. Dyoss, C. C. Earl, J. W. East, D. B. Ebsworth, J. Edwards, L. C. Edwards, W. B. Egerton, D. J. Emms, J. R. England, F. Evans, F. S. Evans, P. H. W. Everitt, H. J. Farn, G. A. Farr, H. F. Farrow, W. J. Faulkner, H. N. Ferguson, R. V. Field, T. P. Finn, G. L. Firth, W. Fishburn, W. F. Fisher, R. Fishwick, W. G. Folkard, L. A. Folkes, W. J. Ford, F. Forrest, J. H. Forrington, H. E. Fowler, W. E. Fowler, J. Franklin, B. Freeth, H. Fulton, E. O. Gadsden, D. G. Galpin, D. Gammel, N. N. Gandhi, L. Garratt, R. P. Garratt, R. le R. Garst, G. A. K. Geddes, A. W. Gegan, B. H. Geisow, L. T. Giles, C. H. Glasgow, E. F. Gleave, R. I. Golding, H. Goldthorne, S. S. Goldthorne, D. Graham, K. H. Graves, F. E. Gray, J. W. H. Graydon, B. W. Grearson, N. W. Grice, J. T. Griffiths, R. L. Griffiths, T. Grime, G. Groves, R. K. Grunau, C. Guest, N. F. Hale, T. H. Hale, M. W. Hall, A. E. Hamilton, M. Hamylton, G. Handley, T. Hardie, N. Hargreaves, G. Harker, A. S. Harman, D. W. Harrison, G. B. Hart, E. T. Hartley, G. W. Hartley, J. A. Hartley, G. E. Havelock, W. D. B. Haynes, A. E. Hayward, R. Hayward, V. A. Hayward, J. W. E.

Hearn, H. G. Heath, W. H. Hedger, E. E. Hempsall, J. N. Hemsley, R. Hewetson, L. A. Hewitt, L. P. Hewkin, A. Hildred, W. J. T. Hockey, B. G. Hockridge, A. L. Hodgkins, S. C. Hodgson, J. Hogg, A. Holroyd, N. C. Holmes, D. P. Holt, C. P. Homes, E. Hood, W. H. Hooper, C. Hopkins, J. S. Hopkinson, J. T. Horner, J. W. Horwood, S. W. Hoskins, R. G. Hoye, H. Hubbard, F. E. Huddleston, H. Hudston, G. W. Huff, E. H. Hughes, E. D. Humphreys, A. T. Hunt, J. Hunter, L. Hutchinson, R. J. A. Hylton, H. E. Inckle, P. E. Irving, R. W. Isaacs, R. H. Jane, F. A. James, F. W. J. James, J. H. Jarvis, F. H. K. Jeffrey, G. Jenkins, H. Jennings, A. Johnson, B. G. Johnson, L. Johnson, R. H. Johnson, A. E. Jones, A. J. Jones, C. W. H. Jones, D. A. Jones, W. C. Keen, F. Kelly, J. Kenny, J. C. Kerr, R. D. Kerr, W. Kerr, A. Kettle, S. Kilburn, W. P. N. Kirk, F. D. Kirkland, W. F. Kitching, F. Knight, C. Lacey, J. H. Laidlaw, G. W. Lane, W. R. Larby, J. Lavin, E. G. V. Law, E. N. Laxon, C. C. Layng, R. Leather, A. G. Lee, E. Lee, E. Letts, G. A. Levitt, W. J. Lewis, W. P. Lewis, G. E. Ling, W. J. Lishman, F. Lister, W. H. Littlejohn, H. F. Loftin, F. G. Lomax, F. W. Long, S. G. W. Lovering, H. Low, A. W. Lower, A. Lumb, A. H. Macbeth, M. A. Mackenzie, A. G. Mackintosh, C. D. Macmillan, F. S. Maidwell, H. B. Marson, E. Martin, W. N. Martin, M. McCloskey, G. A. McClune, C. L. McCombie, F. W. McFadden, F. B. McHugh, J. A. McHugh, W. R. McJannett, W. O. McLachlon, J. McMahon, J. G. McNair, C. W. W. Maddern, D. J. Maher, R. W. H. Mark, G. R. Markham, A. Marsden, E. Marsden, H. Mason, R. J. P. Masters, E. H. Mather, H. Matthews, T. Maude, A. J. May, J. A. Medcalf, R. G. Merryfield, A. J. Milburn, H. G. Millington, W. Minshull, D. Moffat, S. P. Mookerjee, J. A. Moore, W. S. Moore, P. E. Moorhouse, S. Morgan, F. S. Morley, G. A. Morrison, I. W. Mudge, W. S. Muffett, W. C. Murray, F. H. Nash, F. R. Naylor, C. F. Neale, R. Neate, A. Newcombe, E. J. Newman, T. F. Newton, A. E. J. Nicholls, A. E. Nix, H. R. M. Nock, J. R. Nortier, E. G. Nunn, T. Nuttall, D. D. Oakley, J. A. Oates, W. E. Oldnall, H. J. F. Oliver, H. J. O'Neill, W. O'Neil, A. L. Orchard, E. L. O'Reardon, H. M. Orme, J. Orme, W. T. Orton, A. Osgerby, T. Owen, F. T. Palmer, J. F. Parker, R. Parker, S. Parnell, A. E. Parr, G. Patrick, F. J. E. Pay, F. T. Pay, A. D. Pead, H. W. Pellow, C. E. Perkins, M. Perry, M. F. Peterson, C. F. Pettit, A. F. Pike, H. W. E. Pike, R. W. Pile, W. J. Pole, C. C. Postill, F. P. Powell, J. W. Powell, G. E. Powles, H. S. Pratt, S. Pratt, H. B. Preston, R. Preston, E. H. Price, H. J. C. Pritchard, H. G. Prosser, J. M. Purves, K. E. Pyne, T. Quinton, H. W. Rainbird, G. Ramsbottom, W. Reason, D. S. Redhead, W. Rees, G. W. Reeves, H. H. Reid, J. Reid, R. C. Relf, R. J. Richards, W. E. Richards, E. P. Riley, L. C. Ringham, J. H. Rixon, J. Robinson, T. Robinson, R. M. Roddham, R. R. Rogers, J. E. Rogerson, W. H. Rogerson, R. G. Rose, T. A. Rose, W. A. Rounsivell, S. K. Roy, W. H. Rummey, J. Rylance, L. C. Saam, O. A. Sabin, F. B. G. Sammons, C. Schofield, R. A. Sealy, D. Seaton, W. F. Shelton, C. R. Shepherd, R. Shore, W. H. Shrieves, R. Siddall, W. Sidebottom, J. Silcock, J. W. Simpson, W. G. Simpson, D. J. Sinclair, C. W. Skelton, S. A. Smallwood, F. H. Smart, C. R. Smith, C. R. Smith, E. Smith, F. G. Smith, F. S. Smith, G. E. Smith, J. Smith, J. J. Smith, J. J. S. Smith, W. I. Smith, R. R. Speck, F. Sproston, H. E. Stacey, G. W. Staniforth, H. J. Stanley, H. Stansfield, J. M. Steer, J. E. Stell, H. Stevens, J. I. Stiassny, E. C. A. Stinton, L. H. Stone, E. E. Storm, R. D. Stachan, T. J. Suffolk, C. Sumner, E. G. Swain, E. H. Sweetings, M. H. Talbot, Y. Tandan, G. E. O. Taylor, H. Taylor, H. C. Taylor, J. H. Taylor, M. C. Taylor, N. M. Taylor, R. V. Taylor, S. Taylor, E. T. Teasdale, W. A. Temple, C. J. Thomas, I. Thomas, A. Thompson, C. H. Thompson, A. G. Thorburn, L. Thrippleton, A. R. Thurman, R. C. Thurman, W. C. Thurston, W. J. Tilbury, H. G. Tillotson, J. Tocher, C. Toeman, A. Townsend, C. C. Trapp, L. S. Trew, E. J. S.

Triggs, O. E. Trivett, N. A. Tucker, A. W. Turner, J. T. Turner, A. T. Tyre, C. Unwin-Portsmouth, S. A. Vandy, G. E. Velge, W. L. Voyle, S. A. Wade, S. D. R. Wadhawan, W. V. Walbank, A. Walden, C. G. Walker, W. H. Wallis, C. J. V. Walters, G. Ward, W. H. Ward, W. P. Ward, F. E. Wardle, P. Watson, W. Watson, R. J. Wearmouth, W. W. Webber, A. H. Webster, E. A. Webster, C. A. Welch, W. J. C. Wells, G. M. Wharton, L. S. Wheatley, E. A. Whitehorn, D. S. Whitelaw, G. H. Whiteley, C. W. Whithear, H. G. Whittaker, G. W. Whitworth, S. F. Wiggins, S. Wilcock, E. A. Wilkes, F. C. Wilkins, J. Wilkins, M. T. Wilkinson, C. V. Williams, J. G. Williams, J. R. Williams, L. V. Williams, R. A. Williams, S. Williamson, G. A. Wilson, T. Witherspoon, J. E. Witts, J. Woods, C. Woods, W. F. Woodward, A. S. Woolway, L. W. Worthington, E. J. Wright, H. Wright, H. C. Wright, J. H. Wright, R. Wright, S. Wright, T. C. Wright, B. R. Yallop, R. C. Yates, J. E. W. Youston, D. P. R. Yule, T. Zweigbergk.

FROM ASSOCIATE TO ASSOCIATE MEMBER :

W. H. Davies.

FROM GRADUATE TO ASSOCIATE MEMBER :

F. G. Burrell, R. W. Chapple, B. N. Cooper, J. M. Corbett, F. N. Humphries, D. E. Kent, G. F. Moore, J. R. Whitby.

FROM STUDENT TO GRADUATE :

C. F. Bateman, W. J. Botting, E. Cars, F. H. Clarke, L. R. P. Francis, J. R. Gay, P. Griggs, W. A. Hendrie, D. C. Howard, E. Jackson, P. J. Lawrence, A. Measures, R. D. Owen, B. L. Soane, R. T. Vickers, G. Shaw, G. C. Walford.

PRESIDENTIAL ADDRESS

given to the London Section of the Institution of Production Engineers on October 20th, 1949

by W. CORE, M.I.P.E. *

SELLING TO THE PRODUCTION ENGINEER

First of all I wish to express my appreciation of being honoured as your President for this session, and to thank your committee for the help already given in my early stages of office.

The attainments of our past Section Presidents make me realise the high standards set and maintained in this post, and " following in their footsteps " will not be an easy task.

Your knowledge of the outstanding work achieved by our retiring President, Mr. Frank Laurens, during his two years of office, will endorse the tribute which I wish to pay him tonight. Under his guidance we have held lectures covering a wide range of subjects, and have all admired the able and dignified manner in which he has presided. His duties extended beyond this hall, however, and Mr. Laurens has worked wholeheartedly for London Section on Council and on Committees, where his sound judgment has proved invaluable.

When considering a subject for my address to you as Section President, I thought of the repeated exhortations made by leaders of industry, engineers and politicians for increased and better quality production at lower costs.

By this time we must all have realised that whilst talk about production can be left to politicians, achievement will always rest largely on those responsible for the carrying out of production in the workshop, supported by Managements which give active and practical attention to industrial initiative, modernisation and re-equipment in its several spheres.

I would like specifically to refer to the part which machine tools and equipment—in which are included jigs, fixtures and auxiliary products made by specialists other than machine tool makers—can contribute towards the national need to maintain or regain Britain's reputation as supplier of highest quality goods at competitive prices.

* *London Director, Alfred Herbert Ltd., Coventry.*

Left to right: Mr. W. Core, Mr. J. E. Hill, Chairman of Council, the retiring President, Mr. F. P. Laurens, O.B.E., and Mr. H. Townsend, Secretary of the London Section.

THE APPROACH OF THE BUYERS' MARKET

Until this year, post-war demands for British goods have exceeded our capacity to supply, and as a nation we have been in danger of deluding ourselves that "good enough" would do and that quality standards and selling prices were secondary considerations.

With the arrival of the buyers' market, all manufacturers must be prepared for the real test of efficient manufacturing and selling of their products, and only firms equipped to meet both these demands will be able to combat the coming competition in world trade and still make that net profit to which efficiency, enterprise and effort are entitled.

THE NEED FOR CO-OPERATION BETWEEN BUYER & SELLER

When goods have been made—sometimes even before their manufacture—they have to be sold, and the relationship between the Production and Selling departments of a business must be a very close one if success is to be achieved. This harmony is equally important in the case of Production Engineers and Technical Sales Engineers who, whilst employed by totally different companies,

have a dual responsibility in determining the right type of equipment to be installed.

The need for this close co-operation today is more than ever evident, and in suggesting as a subject for my address " Selling to the Production Engineer," I might equally well have chosen " Liaison between Buyer and Seller of Machine Tools and Equipment." It is not always easy to select a title for an Inaugural Address because, in my opinion, this should embrace a subject of interest to Section Members, related to that with which the President is associated.

The majority of our members are concerned daily with Production in the Works, including machining, inspection, handling, administration and other problems, whereas the past 25 years and more of my life have been associated with the Technical Sales of Machine Tools. These years have brought me in touch with many Production Engineers in various industries, and as our Institution papers are usually associated with direct Production, Design or Administration, I feel that this address would, at least, provide a change of interest.

EVOLUTION OF MACHINE TOOLS FROM USERS' EXPERIENCE

The idea prevails that new machine tools and methods are introduced by machine tool makers. This is only partly correct, because progress in design and labour-saving means is more frequently the outcome of consultation and discussion between buyer and seller—in most cases between the production engineer as buyer and the machine tool sales engineer. Many important developments have arisen from what originally appeared to be quite simple suggestions. Generally, improvements in the design of established machines come about slowly and are evolved from the constructive criticisms of users. It is often the man on the shop floor who finds from daily experience where a machine or its equipment can be improved to meet his own requirements. The user finds weak spots in design and suggests improvements in manipulation, chucking or work holding facilities, chip disposal and other factors which are so vital in reducing the floor to floor time.

PRODUCTION AND SALES ENGINEERS FACE SIMILAR PROBLEMS

Today, the buyer of machine tools and equipment is usually the production engineer responsible for seeing that the most suitable equipment is supplied to the shop, and it is in his own interest to investigate current trends in design and methods and to retain a receptive mind.

The technical sales engineer has a similar problem. It is his duty to advise the best equipment for the job. Selling *production* is more important than merely selling machine tools. It is the

duty of a responsible sales engineer to recommend the buying of a competitive product when he has not the right equipment to offer.

The customer's problem must be the paramount idea in the mind of the sales engineer. This can only be obtained fully by discussion with the men responsible for production—if necessary, on the shop floor. The features of a machine tool itself must be related to its equipment and to economies in use. A sale must be justified by a saving of cost in performance or improved quality of product. This extends beyond the mere removal of metal and must be regarded from a standpoint of investment to which later reference will be made.

BRIEF REVIEW OF THE BRITISH MACHINE TOOL INDUSTRY

The history of the British machine tool industry provides a fair criterion of the changes which have taken place in our national industrial progress. The early days of the industry were mainly occupied with the manufacture of parts for marine and steam engines, locomotives, ship and textile machinery, and machine tools consisted chiefly of heavy and medium duty types. The advent of the internal combustion engine and electric power, with their effects on transport; the demand for cycles and motor cars, the production of electric motors and switchgear, radio sets, vacuum cleaners, refrigerators and other domestic appliances, contributed largely to the growth of lighter and higher speed machine tools.

The aircraft industry is an outstanding example of rapid expansion, and within little more than a decade, changes in design, and the use of new materials for engines and frames have called for a complete reconsideration of earlier machining practice.

Special purpose machine tools have been designed such as spar milling machines—due to the change from tubular to skin stressed construction of air frames—multi-tool lathes for turning fins on cylinder heads, multi-spindle drilling and tapping machines for stud holes in crank cases, and forming devices and machines for blades and impellers. Again, I would emphasise that machine tools and equipment are largely the result of users' demands, and stress the need for close collaboration between user and maker.

SIMPLIFICATION OR ELABORATION IN DESIGN?

The evolution in production needs—both in regard to modified designs and quantities required — makes the consideration of simplification versus elaboration one of great importance to user and machine tool builder alike. Complaints are often made by the buyer that there are too many speeds and feeds or other elaborations on the machine for his work, and obviously the design of a machine producing the same or very similar parts, month in and month out, will call for simplification.

Some parts may demand an entirely special machine which would be difficult to modify when designs change. This situation can frequently be met successfully by the use of standard unit heads—arranged for milling, drilling and tapping operations and mounted on a special base or bases around the work.

In 1935, which was a fair pre-war standard, the British machine tool industry employed approximately 21,000 operatives; the total number of employees in the engineering industry in Britain was practically 70 times that of the machine tool industry. Four-fifths of the firms in the machine tool industry today employ less than 300 operatives, and many of these firms make one type of machine tool only, which enables them to offer specialised advice to the user.

Having referred to the need for close collaboration between user and maker, I suggest that the next consideration in the production engineer's mind as a buyer, is that of trends in design and machining practice quite apart from constructional features of the machine tools themselves.

EFFECT OF WAR CONDITIONS ON DESIGN

Although the urgency of war-time conditions temporarily halted normal progress in design, the experience gained through shift working—particularly with unskilled or semi-skilled labour—enabled machine tool builders to incorporate features in post-war designs which would have taken much longer in the ordinary course of normal peace-time usage.

Important improvements in design and construction have been introduced due to experience gained during the war years, when machine tools were called on to withstand almost continuous duty, alternating between heavy roughing cuts and fine precision finishing cuts. It speaks well for the robustness and accuracy of immediate pre-war designs that these arduous conditions were met so successfully.

In addition to the mechanical efficiency of the machine itself, safety and comfort of operation have received careful attention, as it has long been accepted that such working conditions for operators are not merely humane, but also help in obtaining increased production.

PRESENT DAY TRENDS IN DESIGN

Any attempt to give more than brief details of individual machine tools is beyond the scope of this address, but a short survey of trends in design and their effect on some of the principal machining operations may be mentioned as follows :—

(1) The adoption of direct electric drive and the provision of increased speed and feed range, with easier and quicker control and rapid power traverses.

(2) Greater power and rigidity to permit tungsten carbide and other high speed cutting alloys to be used to the fullest advantage, and to deal satisfactorily with the exacting materials now in use and the close tolerances to which one must work.

(3) The use of improved materials ; alloy steels in spindles, gearing and transmission shafts, better quality cast iron in beds and saddles, hardened slides and the extension of ball and roller bearing applications.

(4) Hydraulic control of grinding machine slides and the incorporation of automatic working cycles.

(5) The use of pneumatically, hydraulically and electrically operated chucks and work holding fixtures.

(6) Better lubrication and chip disposal arrangements.

(7) Increased ease and safety of operation by the provision of push button control and the efficient guarding of rotating parts.

(8) Multiple tooling and multiple station machines extending to transfer machines.

(9) Electronic applications.

TURNING The centre lathe now wears a completely " New Look " compared with the not very distant years when 6 or 8 speeds and feeds met the requirements of a skilled turner. The demand for wider ranges of speeds and feeds to cope with the variety of material and size of work to be handled has resulted in lathes being made with as many as 24 speeds and 60 feeds.

The call for high speed finishing has modified design to the point where final drive to the spindle is by belt, in order to eliminate the possibility of gear tooth markings on the finished surface.

Machine tool turning performance (both horizontally and vertically) has been improved by the application of copying devices—either in the form of attachments or as an integral part of the machine. With the latter, a production run can be changed over quickly to a small lot of differently shaped pieces using manual control without disturbing the automatic setting. The automatically operated machine will do repetition work accurately and with minimum change in set-up time from one class of work to another.

Copy turning is virtually equivalent to automatic turning. The control of tool motion through a template eliminates the adjustment of the tool to different diameters and lengths. The use of one tool only ensures short setting up time and low tool costs, so that small and large batches of work can be dealt with economically.

The growth of pressure moulding which calls for a wide variety of shapes in plastics and aluminium and zinc base alloys, and of gravity moulding for ornamental glass, has created a large demand for intricate master dies. These are often required in multiple sets, and lathes have been specially designed to meet this need.

In the capstan and turret lathe division, headstocks are designed to enable spindle speeds to be pre-selected merely by turning a dial, and finger pressure on a knob in the centre of that dial brings the required speed into operation. This can be done whilst tools are cutting, and during facing operations the correct peripheral speed can be maintained by making several changes of spindle speed easily.

British makers of single and multi-spindle bar and chucking automatic lathes have provided an outstanding example of our national ability to manufacture highest class machines which were formerly imported from U.S.A. and Switzerland.

AUTOMATIC MINDEDNESS

War and post-war manufacturing conditions are making us more and more " automatic minded," so the possibilities of single automatics should be very closely weighed against the use of capstan and turret lathes. Compared with the need for one operator per machine on the capstan or turret lathes, four or even six single spindle auto lathes can be run successfully by one tool setter and one feeder to load and unload the machine. The comparatively simple tooling which can be used on multi-spindle automatics—both of horizontal and vertical types—again affords greater scope for dealing with smaller quantities on multi-spindle machines than would ever have been thought of in pre-war days.

There is abundant opportunity for close discussion between production engineers and machine tool makers to consider the extension of machining on automatics. This does not merely imply the use of automatic machines as they are commonly understood, but investigating whether relatively small quantities can be handled more economically by using methods which one formerly associated only with larger scale production, e.g., the use of multi-spindle drill heads.

Although pneumatic, electric and hydraulic chucking is by no means a war-time innovation, its use was then greatly extended, particularly where female labour was employed. This can be associated with " automatic mindedness," using the expression in the broad sense of reducing floor to floor times.

MILLING

Developments in cutter design have affected both machining practice and the design of milling machines.

Negative rake cutting is by no means a " cure-all," and has its limitations—particularly if used on machine tools lacking the necessary power, speed and feed ranges. However, developments

with carbide cutters with various combinations of radial and axial rake give indications of scope for greatly increased production. More power is required but cutters stand up to higher speeds without crumbling. Feed rates can be high, as thick chips have been found to be more economical relative to power consumption and tool life, than lighter sections of chip.

Milling cutters, due to multiplicity of teeth, tend to exert an uneven torque on the drive if there is much flexibility in the train of gears and shafts, and the cutter speed becomes irregular with consequent detriment to cutter life. The rotating speed of the cutter spindle can be evened by the use of flywheels—now usually built in to the machine where production runs with carbide tools are required.

Savings in machining time again emphasise the necessity of reducing loading and unloading times which become a high proportion of the operating cycle, and close attention must be given to quick loading fixtures.

When quantities are large or continuous production is required, the single purpose machine will enable operations to be combined, and an otherwise costly process is reduced to comparatively simple proportions, if these machines can be built up from standard units.

DRILLING Pre-selection of speeds and feeds has extended to drilling machines, where considerable attention has been given to ease of control and reduction of heavy manual effort on the part of the operator.

Standard drilling or tapping head units can be arranged with the use of indexing fixtures to meet almost any combination of needs, either vertically or horizontally. With corresponding milling units, transfer machines can be built up into a composite machine tool which may well be much more wisely used in future in this country—particularly in view of increasing labour costs, and the need for the minimum of handling and conveying.

It is impossible to extend this survey to grinding, planing, broaching and other fields, except to mention that the same main characteristics prevail as in those operations already mentioned—the aim at multiple cutting, fixtures designed to reduce handling times, and ease of operation. The limit of multi-tooling is usually determined by the rigidity of the work-piece.

Grinding practice tends to eliminate manual gauging by furthering the use of mechanical and electrical size gauging devices, while multiple wheel set-ups for external grinding are the outcome of the constantly progressive urge to cut machining times. For instance, four main bearings on a crankshaft can be ground simultaneously by the application of a wheelhead with dual wheel slides—each slide carrying two grinding wheels.

SLIDES Several slides were then shown to illustrate the points already referred to in the address—and were introduced to indicate trends in design or practice rather than any particular features of makers.

They included :—

1. A Swiss copying lathe employing either a thin metal template or prototype as master—hydraulically controlled cutting tool—and illustrating ease of set up and change-over.

2. British made centre lathe fitted with hydraulically controlled duplicating attachment.

3. American electrically controlled unit fitted to British vertical boring mill enabling cutting tools to reproduce forms from sheet metal template and tracer.

4. Capstan lathe simplified to suit special work of non-ferrous nature where both external and internal threading operations are required. Saddle is omitted and up to 30 reversals of spindle per minute are obtained by actuating reversing switch in headstock by means of push-rod mounted above turret. Examples of high production and tooling layout were illustrated.

5. Adaptation of capstan lathe—simplified—to high speed turning of shafts—with simple form of chip breaker for carbide tools.

6. Pre-selection of speeds and feeds on radial drill—through direct reading dials. Changes are selected when machine is running or stationary—and made smoothly when required.

7. Use of unit milling and drilling heads mounted on bases to illustrate composite machine tools built round work requiring milling, drilling and tapping operations. Examples were shown applied to work on cylinder blocks, artificial silk pump bodies, pump housings, and having air and mechanically controlled quick-acting clamping fixtures.

An outstanding example of close collaboration between maker and user was indicated by slides which showed the machining of 13 annular dovetail grooves in the taper bore of an aluminium alloy compressor casing.

Optical equipment enables the operator to control all movements confidently and accurately although unable to see the cutting tools in operation.

Machining operations and settings were described but stress was laid on the fact that the machine and methods employed were largely the outcome of close consultation between user and maker.

Finally, one or two slides were shown to illustrate savings made on a capstan lathe by attention to consideration of tooling equipment—employing high speed and tungsten carbide tools, the latter with negative rake applications to cutting off and turning bar work.

THE CHOICE OF PLANT

The production engineer is offered a wide choice of labour saving and cost reducing features in machine tools and equipment of today. What is his problem? His first reaction to a new project or to a demand for increased quantities of his present manufactures is " How many are required—in what time—and by what means ? "

If the quantities are of the one-off type or small multiples of one, he naturally chooses tool room or " knife and fork " methods. Due to the absence of jigs, fixtures or special tooling, the universal type of machine such as the lathe, radial drill, planer and shaper are used and improvisation is often the keynote of success. In such shops one generally finds supervision depending on a fund of past experience to solve day-to-day problems, and many of us can recall the ingenuity of the skilled operator, who took a pride in his work, in overcoming handicaps in spite of his rather limited equipment. Of course, the cost of " doing one's best with the minimum of plant " is generally high because so much depends on the skill of the operator.

The step by step progress from unit to batch and mass or line production is governed by quantities and the extent to which special tooling should be employed.

Batch production can be defined as " producing a wide variety of parts in limited but recurring quantities." The numbers made each year will not justify special plant being installed and any approach to mass production methods could not be considered due to capital cost. General purpose machines are therefore used—to allow ready adaptation to changes of programme. In conjunction with simple jigs and fixtures this equipment produces work economically, although not as cheaply as is possible with the line production methods handling bigger quantities.

We have all experienced the use of capstan and turret lathes on batch production work and have noted the justification for the use of special tooling equipment to supplement makers' standard equipment as quantities increase or similar parts with slight variation in sizes have to be dealt with in batches. The same principle applies to most machine operations of the general purpose type, whereas special or unit construction machines become largely a consideration of quantities required, labour and floor space available.

When standardised products are made in such large quantities as to justify plant being laid down for the sole purpose of manu-

facturing one product only, we reach the mass or line production stage. The repetition nature of the work justifies more highly specialised plant and the use of more elaborate jigs, tools and fixtures in order to produce to schedule, and obtain the required numbers of completed units to ensure a smooth flow to the assembly line. Here, one has to consider provision against the possibility of breakdown in plant—the seriousness of which may justify the installation of a number of reserve machines ready equipped for this emergency.

The old belief that a mass-produced article is secondary in quality can be discounted, because modern machine tools and methods ensure interchangeability.

There is a danger that the planning engineer may become rather one-track minded, due to increased specialisation on mass-production methods. In batch and unit production, he has to be flexible in outlook, and I might illustrate the point by relating an incident that occurred in one of the leading motor car plants in U.S.A. The production of cylinder blocks and heads was being discussed, and after dealing very fully with queries on the blocks, the planning engineer was asked " Now how would you tackle this operation on the cylinder head ? " The reply, " I don't know, I'm a cylinder block man," may seem incredible, but the incident is true.

The short references to unit, batch and mass or line production lead to consideration of the condition of plants in Britain today, and their capacity to cope with our national need for competitive production of highest quality. This should be of equal concern to the production engineer as buyer, and to machine tool builders, as sellers.

CONDITION OF TO-DAY'S PLANTS

The war years doubled and trebled normal wear and tear on machine tools, and conditions demanded the retention of models which would normally have been discontinued. That was inevitable and, as already mentioned, pre-war designs did yeoman work under war-time conditions of use and abuse.

In recent years the Government decided that up to fifty or sixty per cent. of new British made machine tools should be exported. However this decision may have been justified on the grounds of national economics, the fact remains that other countries have been provided with the means of producing their products both better and more cheaply. In some cases this may mean lower priced imports to this country, and in others we are faced with new competition which must be met by reduced manufacturing costs at home.

Our Government offered British manufacturers good quality war-time surplus plant at reasonable prices to tide over the

immediate post-war period, but are all these secondhand machines now equal to the competitive needs of today? No industry—however long established—can afford to retain inefficient plant and production methods. In fact, the longer an industry has been established, the more advanced should be its methods—judged by opportunities afforded for progress throughout the years—but we all know of many vintage machine tools which are affectionately and proudly lauded as being very many years old. Although they may pay tribute to the lasting quality of British built tools, they also remain as a monument to departed progress.

OBSOLESCENCE Before the war, many firms replaced machine tools only when they could no longer do the job for which they were designed. Insufficient attention was given to determining whether a new machine could do the job better and cheaper than the old machine; or whether revision of the plant layout could show that two machines of latest design had output capacity equal to or even better than three existing machines. Obsolescence—rather difficult to detect in its early stages—moves on continuously and often rapidly.

Manufacturing equipment may be in good working condition and turning out apparently satisfactory work, but a competitor's plant may, by means of better production methods or more up-to-date equipment, give the first warning that all is not well at home.

Age alone is not the standard by which obsolescence should be gauged. A twenty-year-old lathe in a maintenance shop may be quite justifiably retained, whereas a five-year-old machine in a production line is obsolete because of subsequent developments in design or technique. Again, one may find that two identical machines, installed at the same time, give different performances over a period due to the nature of work handled and to variations in operating skill or interest, and any loss of accuracy must be thoroughly investigated. The planning department is usually aware of these discrepancies—if not, the tool setters and operators are.

Further, there are replacement considerations apart from those of immediate reduction in production costs. Unless, for instance, the tool room is well equipped, tools, jigs and fixtures will cost too much to ensure the close standards of accuracy required in the production department. A machine may not run full time and still be a better proposition than one which is fully employed, but needs correction of its inaccuracies by secondary operations or expensive handwork. Every company has its own standard of replacement and depreciation values, and only very broad observations can be made here.

Although methods of computing the investment value of new equipment may vary, the early stages often rest with the production

engineer who has to decide when a machine shall be replaced, and by what. The machine tool-builder makes one profit per machine, but the user should make a daily profit so long as the machine is in production or until it is replaced by one which will do so. Instead of regarding the purchase of new equipment as a drain on cash reserves, one should investigate whether existing plant is not a bigger drain on them.

These observations should be regarded from the standpoint of the buyer rather than that of the seller, because I feel that production engineers who are responsible for plant installation realise full well that without a healthy and competitive machine tool industry, there will be little or no future for any of the engineering industries in which they are employed.

MOST MEMBERS OF AN ORGANISATION "SELL"

Selling rests to a large degree with every member of an organisation from Managing Director to telephone operator. Consider the different effects on a prospective buyer who, on the telephone, is confronted with "Who *are* you?" or "What do *you* want?" compared with "Good morning, we are Blank Ltd.—can I help you?" A Managing or Sales Director who takes a personal interest in serious complaints regarding performance or service, sets a standard which is reflected throughout his organisation.

Sometimes there is a tendency to regard civility as servility, and our so-called national independence of spirit results in a brusqueness which, though unintentional, creates a false impression on the buyer.

SERVICE

Service is usually the first step towards further sales. We may not all subscribe to the view that "the customer is always right," but prompt service, willingly given, goes a long way towards meeting this viewpoint. The customer is always entitled to efficient and satisfactory service, and this should make him feel that he is always right. A sales department should insist that its Company provides operators' and service manuals which will enable the operator easily to acquire the knowledge which will ensure best results from the use of the machine, and also allow the maintenance engineer to identify readily and quickly a spare part which may be urgently required.

Finally, I would urge Graduate and Student members of the Institution to blend their academic and theoretical knowledge with a thorough grasp of practical workshop problems. They must be alive to new developments and maintain an open-minded attitude towards them, since our present knowledge of materials, cutting mediums, and general manufacturing technique is likely to be revised at short notice.

HUMAN ENGINEERING IN INDUSTRY

by C. M. KENNEDY, A.M.I.P.E., A.I.I.A.

Presented to the Sydney Section of the Institution, March, 1949

You may query why a paper entitled " Human Engineering in Industry " should be read at a gathering of Production Engineers. I think it can be said that the subject is of paramount importance for two reasons.

In the first place, there are undoubtedly more difficulties experienced today in the sphere of human relations than in any other sphere of management activities. Secondly, I believe there are an ever-increasing number of responsible people who sense that the progress of Australian industry depends on the success of its human relations. Here, in this country of ours, we have raw material, manufacturing facilities, engineering ability, and excellent technical institutions—apparently everything we need for our industrial development.

We are virtually experiencing a full turn of the wheel. Before the growth of large-scale industry, aspect was important. The early industries were the home arts and crafts ; the human relations were personal because the groups were small. However, with the development of science, and its offspring engineering, which brought about larger industrial units, the light of human relations in industry became clouded, for it is beyond question that it is more difficult to maintain good human relation in large units.

As production engineers, how does the subject of human relations affect us and the respective roles we occupy in industry ? I feel you will agree with me that perhaps the greatest problem facing us today is how to increase production per man hour—which in effect resolves itself into the question how can we obtain higher efficiency of the human factor in industry.

Increased output per man-hour does not necessarily mean a greater expenditure of energy by each employee, but rather the better utilisation and more economic use of manpower effort. It may possibly imply more mechanisation of processes, but it also involves the removal of any obstacles to personal efficiency.

In the past we have concentrated our energies on technical development at the expense of the human aspect, consequently the techniques of scientific manufacture are infinitely more advanced than the methods of managing men.

Admittedly, psychology is now being applied to our industrial problems, but the scientific study of psychology is more recent and much less extensive than that of chemistry and mechanics—the

amount of indisputable fact in psychology is infinitesimal as compared with that of the older sciences. In short, less is known of the human factor, the most vital and important factor of industry, than any other.

Even so, what we know of the human element in industry is considerable. Unfortunately, however, we have failed to make practical application of that knowledge.

For example, when a machine has working parts with undue frictional loss involving both additional wear and use of power, we take immediate steps to effect improvements, yet where the human factor is involved, friction is disregarded, and such lack of interest in the manpower machine has strange results ; either there is a firm belief that no differences exist, or, if their difference is acknowledged, there is an equally firm belief that human nature being what it is, friction is inevitable.

It is not generally appreciated that it is only by neglecting such problems as arise in the human side of industry that such an enormous amount of time and energy can be devoted to technical matters, and as a result our methods of handling the human element in industry and the technique we apply to the solution of its problems, sadly lack the skill with which we tackle our process problems.

Indeed, it is a sad reflection of our attitude towards the human aspects of industry when one realises that we in Australia are only now, twenty-five years after their inception, beginning to pay attention to and be guided by the results of those now famous experiments conducted by the Western Electric Co., of America, and known as the Hawthorne Studies. Briefly, these experiments were first introduced for the purpose of studying the effects of lighting on production output. Naturally, at the commencement of the studies it was assumed that any improvements made to lighting facilities would result in greater output, so a simple method of testing this theory was set up : Two groups of operators, one a " test " group, the other a " control " group, were selected, the former working under improved lighting, the latter under the usual degree of light. The output of the test group increased, but so also did that of the control groups ; further tests were made by decreasing the intensity of light of the " test " group to below normal, but the output not only of the " test " group but also of the " control " group, continued to increase.

These results were not as expected, and clearly some unknown factor was responsible for such results. It was illogical that the productivity of the " control " group should vary as there had been no change in their lighting conditions, and why should the " test " group show an increase of production when the degree of lighting was reduced—in one instance to that of pale moonlight ?

It was decided to put a more comprehensive series of tests into operation—and I think I can best illustrate the type of tests conducted over a period of some years by the Western Electric investigating engineers, and the results achieved, by quoting from Stuart Chase's article, " What Makes the Worker Like to Work ? " which appeared in the February, 1949, issue of the " Readers' Digest."

" *Periods 1 and 2.* Normal conditions : a 48-hour week, including Saturdays : no rest pauses. Each girl produced about 2,400 relays a week.

Period 3. The girls were put on group piecework. As one would expect, output went up.

Period 4. Two rest pauses of five minutes each were introduced. Output went up again.

Period 5. Rest pauses were increased to 10 minutes each. Output went up, sharply.

Period 6. Six five-minute rest pauses were tried. The girls complained that the rhythm of their work was broken. Output fell off slightly.

Period 7. Rest pauses were reduced to two, one with a hot snack provided by the company. Output went up.

Period 8. Same as Period 7, except that the girls were dismissed at 4.30 p.m. instead of 5 p.m. Output went up sharply.

Period 9. Same as Period 8, except that closing time was moved to 4 p.m. Output remained on a level.

Period 10. Same conditions, but with closing time at 5 p.m. Were the girls discouraged by losing an hour a day of liberty ? They were not—weekly output went up with a rush ! The research staff whose assumptions were disintegrating, were completely at a loss. Some unmeasured force was still pushing output up. So, after trying Saturdays off for twelve weeks, in *Period 11*, and finding that the output remained unchanged, they prepared for the greatest test of all.

In Period 12, every improvement of working conditions made over a year and a half was taken away, and the girls went back to the exact physical conditions of Period 3—no rest pauses, no company hot lunch, a full 48-hour week. According to all the rules of common sense and factory management, this should have crushed their spirits and reduced their output. Instead, output jumped to a record peak of 3,000 relays a week per girl."

In addition to the changing conditions mentioned in the twelve periods cited, quality records were kept, recordings of the varying temperatures and humidity of the test room were taken, and each operator was subjected to a physical examination at regular intervals. Records were kept of what the operatives ate for breakfast, lunch and dinner, and the number of hours they slept at night, so that a vast amount of data was collected, about a small group of workers for a long period of time. A statistician spent some years endeavouring to relate variations in output with variations in physical circumstances of each of the operators comprising the test group ; for example, the hours each operator spent in bed the night before were correlated with variations in output the following day. He also correlated the variations in output with the amount of rest the operator had had two nights before—just to be on the safe side, in case the effect of being out late one night was not felt during the following day, but on the day after that.

However, this attempt to relate changes in physical circumstances to variations in output—" *resulted in not a single correlation of sufficient statistical significance to be recognised by any competent statistician as having any meaning.*"

It would be wrong to say this negative result was the only conclusion reached. Fritz Roethlisberger, the scientist who had a great deal to do with the Hawthorne experiments, commented some years later that " What all the experiments had dramatically and conclusively demonstrated was *the importance of employee attitude and sentiments*. It was clear that the responses of workers to what was happening about them were dependent upon the significance these events had for them. In most work situations the meaning of a change is likely to be as important as the change itself. This was the great " éclaircissement," the new illumination, that came from the research. Curiously enough, this discovery is nothing very new or startling. It is something which anyone who has had some concrete experience in handling other people intuitively recognises and practises. Whether or not a person is going to give his services wholeheartedly to a group depends largely on the way he feels about his job, his fellow workers and supervisors—the meaning for him of what is happening about him."

Those of us who are responsible for the organising and directing of work people in the daily task, can learn and be guided by the results of the Hawthorne studies, if only we are prepared and willing to accept our " Human Engineering " responsibilities in the same way in which we accept our Production Engineering responsibilities.

Obviously there is a great deal more one could say relative to the Hawthorne studies, but time does not permit. However, I should particularly like to mention the close association of Australia

with the studies, through the medium of Elton Mayo, the man who controlled and directed the work of the Hawthorne engineers, the man who since his early association with these studies has made a lifelong and firsthand study of industrial relations in industry. Indeed, it has been said in America that if there were a Nobel Prize for work done in the field of industrial relations, the recipient would be Elton Mayo—an Australian, born in Adelaide, and a graduate of the University of that city.

Fritz Roethlisberger said that the most important result of the Hawthorne studies was the demonstration of the importance of employee attitudes and sentiments in respect of what was going on about them in their daily task, and the reaction and response of employees as to what was happening around them in their section, department and organisation.

In other words, we are all very interested in what is going on around us. We humans are a curious type, we are possessed of an insatiable curiosity, even about matters which are of no direct concern to us personally. We like to know what is going on, and our curiosity answered, we enjoy a very happy feeling of satisfaction.

I would like to stress that last point further by quoting part of the foreword to a recent publication entitled "Teamwork in Industry," written by Lord Forrester, whom we all know as a leading British Industrialist and an indefatigable worker on behalf of our own Institute. Lord Forrester says: "The politicians of many lands are seeking to establish and maintain an equilibrium of work for all, which they term full employment. To most the term 'full employment' has no positive meaning; it generally implies just 'a state of affairs in which there is no unemployment as we knew it in the 1930's.'"

"To all whose work and life are spent in industry, agriculture, mining, shipping or commerce, in those spheres of group activity where the trivial round and common task are done, more substantial things stand at stake than mere 'no unemployment.' Those who work must know that their labour is used effectively; those responsible must demand a certain increasing efficiency from those who work, and with it (for the two are inseparable) a certain assurance that those who work are happy in their jobs."

Now, let us briefly review what has been said up to this stage. Firstly, it was mentioned that to achieve increased efficiency, it was necessary to remove any obstacles in the path of achieving increased personal efficiency. Secondly, the results of the Hawthorne studies, have shown the necessity for consideration of employee attitudes and sentiments; thirdly, Lord Forrester has stressed the importance of people being happy in their jobs. What are the factors which affect personal efficiency, employee attitudes and satisfaction in one's work? Perhaps we can dispense with

personal efficiency as a direct factor, since if we make a real effort to understand our workers' attitude towards their jobs, give thought and consideration to those factors which are conducive to job satisfaction, and give practical expression to our findings, then personal efficiency will automatically increase.

How can we develop in our employees the correct attitude and sentiments towards our industrial activities?

Should not a carefully selected employee assigned to an appropriate job be reasonably expected to perform it to the satisfaction of his employer and himself? Should not the quality and quantity of his performance at least meet, if not exceed, reasonable established standards? Should he not be personally satisfied and loyal to his employer? If this is accepted, how then can we account for the cases where an employee thus selected and assigned, fails to produce at an acceptable rate, or is disgruntled and indifferent to the interests of the organisation when he is employed?

Surely the answer lies to a great extent in the employee's attitudes and sentiments, conditioned by his personal background and experiences in past and present employment. For example, it may be found in how he feels about his immediate superior or top management, how he feels about company policies and practises, working conditions and his fellow employees. Not so very many years ago, such factors were casually discussed as intangibles, difficult to appraise and impracticable to alter, or again Management may have thought them no concern of theirs. Today, no discerning Management should discount such factors. Management should recognise that attitudes and sentiments—manifested in likes or dislikes, security or insecurity, confidence or distrust—often represent the difference between a good employee and a poor one, the difference between a productive and harmonious organisation and one which operates at a mediocre level and in an atmosphere of discord and strife. Let us examine a few of the circumstances which affect our employees' thoughts and feelings, what factors condition attitudes and sentiments.

(1) One basic cause of poor performance and low morale is the feeling of insecurity among employees. In one sense this feeling of insecurity implies a fear of losing jobs and consequently income. Yet, in a larger sense, it also implies a general lack of confidence in the stability, fairness and competence of those to whom employees look to for leadership.

Insecurity travels down the line; an insecure foreman produces apprehension in his department or section, just as the foreman's insecurity frequently emanates from similar feeling in top management.

Insecurity is a symptom—the cause must be found and eliminated. The employee may feel that insufficient recognition by way of

promotion or wage increases has been given, misunderstanding may exist of conditions affecting the work, the employee may lack aptitude for the particular job, or again be inadequately trained ; whatever the cause, it must be determined and eradicated.

The reasons just given concern what I termed the general sense of insecurity. However, it may be thought that in present day conditions of labour shortage, the worker has little to fear insofar as the security of his particular job is concerned.

If you will allow me, I should like to digress for a few moments and mention briefly the results of an Employee Opinion Survey conducted about the middle of last year by the organisation with which I am associated. What we set out to find was " What does the employee want from a job ? " In our attempt to do so, we listed forty factors which it was considered would affect the employee's attitude in respect of what he wanted of his job.

The following are only a few of the forty factors included :—

(1) Working hours involved—the total per day or per week.

(2) Type of work and the physical strain it imposes on you.

(3) The rate of pay carried by the job.

(4) Bonuses to be won—the amount you can earn over and above your wages.

(5) Music while you work.

(6) Foreman's or supervisor's ability, temperament and personality.

(7) Job Security—the knowledge that the job assures you of permanent employment.

(8) Your confidence in yourself to do the job.

Employees were requested to remain anonymous and choose in order the five factors most important to them.

In this survey we were assisted by eight organisations and six trade unions in six different organisations.

The results of the factors mentioned in the first five were :—

Job Security—68.6 per cent.

Rate of Pay—57.5 per cent.

Advancement Opportunities—37.5 per cent.

Presence of Facilities—25.6 per cent.

Annual Holiday Conditions—21.7 per cent.

Clearly security of employment is of major importance, even under today's conditions.

(2) When management continually acts without determining how the employee group feels about changes affecting them, it succeeds only in fostering an attitude of distrust. No matter how

sincerely inspired the motive may be, it is suspect and liable to misinterpretation. We all quite naturally feel antagonistic towards changes which are thrust upon us without warning. It is not necessary to molly-coddle our employees, but it is very necessary to give them consideration.

(3) Pride of work on the part of the worker is a particularly valuable attitude. He should have knowledge of the purpose it serves and be convinced of its importance. In these days of specialisation, however, the contribution of the individual is generally limited to the manufacture of a small part of the complete product. We must therefore evolve ways whereby the interest of the production line worker is stimulated to approximate to the enthusiasm of the bygone craftsman who completed the product from start to finish. To do so it is necessary to satisfy a basic human want, that is the desire of each individual to feel important. If it can be shown that the work he does is significant, if we can prove that the part the individual makes is essential to the operation of the product as a whole, his pride in the work increases and his self-esteem is enhanced.

(4) A further important factor contributing to unhealthy attitudes is disciplinary action which is arbitrarily imposed ; such action breeds resentment and often further infractions. This is true not only with respect to the individual penalised, but usually it extends to others within the same group, who probably reason that they, too, may find themselves in a similar predicament. Denial to the employee of adequate opportunity to defend himself, insufficient investigation or distortion of the facts all tend to engender adverse attitudes. The important point is not *who* administers the discipline, but *how* it is administered. Management cannot remedy the situation by shifting responsibility for disciplinary action from one authority to another ; the appropriate solution lies in the procedure of uncovering the underlying factual causes of unacceptable behaviour and applying corrective measures impartially and intelligently.

No amount of punishment will adjust or discipline an individual for very long if his misconduct arises out of conditions which remain hidden and unremedied. It is also essential to be consistent in the assessment of penalties, so that the same treatment can be given for like acts of misbehaviour, without predudice or favouritism towards individuals. Good discipline should endeavour to encourage each employee to maintain willingly the standard of conduct necessary for the efficient working of the organisation as a whole.

Lastly, there are two forms of discipline, negative and positive, or they might be termed the old and the new respectively. *Negative* discipline is based on the conception that men must be

made to work, that only by the fear of consequent punishment can they be made to comply with trules and regulations. *Positive* discipline has as its aim the advancement of production and efficiency, by encouraging the necessary degree of self-restraint for the benefit of the group or company. It takes a broader view of industrial conditions, endeavouring to stimulate each member of the organisation to maintain such standards of employment as are necessary for efficient and contented operation.

(5) One of the most important factors affecting employee attitudes and sentiments is the foreman. To the employee the foreman is the management ; what he says and does is interpreted as company policy and practises, therefore it becomes the duty of the foreman, and his responsibility, to engender in those over whom he exercises control, confidence in the fairness and integrity of the company which employs them. To do so, he himself must be reliable, his workers must feel that they can depend upon him. Supervision, like discipline, has changed over the years, and many foremen and executives experience difficulty in getting things done precisely and promptly. Many and varied reasons are given for the existence of this condition, ranging from high wage rates, greater independence of employees, the influence of Trade Unions, and security of labour. I suggest that it may be due to lack of realisation that supervision is a social technique and depends upon the outlook and behaviour of people generally ; failure to discern between personal excesses, and the new freedom enjoyed by labour ; failure to distinguish temporary abnormalities which arose during the war years and what in effect has become a permanent change, incorporating those abnormalities just referred to. As a result, we might say supervision is in a state of transition from the old to the new—consequently, those whose responsibility it is to supervise tend to be either too strict or too slack.

The new concept of supervision as interpreted by Burns Morton implies that supervision is a flexible process : it depends on the temper of the times and the nature of current circumstances, and requires to be correspondingly adaptable.

Authority by consent replaces coercion. In democratic countries men do not respond favourably to force. They make their best efforts when they contribute their energy freely. The old adage holds : " He that complies against his will is of his own opinion still."

Precision must replace guesswork. If accurate work is required from subordinates, the executive must be even more exact. There is no place for the rule-of-thumb and the slap-dash. Organisation is needed instead of improvisation.

Prevention is better than cure, and it is imperative to use foresight in order to avoid difficulties arising. The cause of errors

should be sought and corrected as distinct from dealing out blame for each case where mistakes arise. Men work best when they are contented. Executives should desist from irritations which annoy, and should avoid needless interference and other disturbing features. Stability and security are necessary for continuous and consistent endeavour. Men reflect and respond to their surroundings, and inefficiency at the centre leads to anæmia at the extremities. Future development depends on past experience. Men work most efficiently when they are under the influence of a continuous and suitable incentive, and are inclined to respond better to encouragement than to criticism. Wages are not the only incentive to industry.

Men must have leadership. They crave for example ; admire efficiency ; demand justice ; desire to be recognised ; and respond to encouragement. They know that leadership is neither driving nor drifting.

I have dwelt at some length on discipline and supervision and their effects upon employee attitudes ; in many respects these two factors, discipline and supervision are synonymous. They are also two of the most important factors to which we must direct our attention if we aim to improve human relations in our various industrial fields.

Discipline which regulates human relations in industry is determined mainly in relation to the achieving of results. Maximum productivity of goods to specified quality and quantity and at minimum cost is the chief economic aim of any business, therefore disciplinary and supervisory methods which contribute towards this goal are good, those which detract from it are bad.

The purpose of giving an order in business is to get things done. This statement, however, requires some qualification ; it is not sufficient to get just one job done, not simply one single achievement on one day, but rather the aim is to obtain a continuous performance of a reasonably high level, over prolonged periods. No matter whether the work be of a routine or specialised nature, skilled or unskilled, the same principle of a continuously good performance in quality and effort must still apply. To achieve such a result is mainly the responsibility of those whose duty it is to supervise and control the human factor of industry.

JOB SATISFACTION The second major aspect to which we must direct our attention and thought, in our endeavours to improve the efficiency of the human factor in industry is that of creating job satisfaction.

When a man is enthusiastic about his job, he does his best work. Furthermore, enthusiasm springs from interest, and interest in a job begets devotion to it, and together these two factors create job

satisfaction. Doing what one wants to do, what interests one, is the basis of satisfaction.

What then should we do if we are to give our employees the opportunity of enjoying job satisfaction ?

Again quoting from F. J. Burns Morton, it is suggested :—

(*a*) Discover what men want to do most. It is possible by interview and through selection tests to find out the bent of each employee.

(*b*) Assign employee as far as is practicable to the type of work for which he is most suited, taking account of his natural abilities, judging from his experience, and estimating his potential possibilities from training.

(*c*) Create job interest by explaining the importance of the work and the need for his grade of workmanship, and by giving due recognition for creditable performance.

(*d*) Accept that job satisfaction is a management responsibility ; that leadership determines what the employee feels about his work ; that continuous and considerate supervision is essential to avoid misunderstandings and to ensure consistency, and that employees must be considered as human beings with all their merits and demerits and not as a collection of machines.

Job satisfaction does not mean self-satisfaction, and we must not make the mistake of confusing contentment at work with complacency ; interest in work is positive, interest in self or laziness is negative.

The degree to which each individual absorbs an interest in his work, like ndividual intelligence, varies considerably, the essential feature of a job interest being that the individual *wants* to work, and if we wish to stimulate our employees and infuse interest relative to their work in them, we must use persuasion and not force. Undoubtedly, if we were to ask our employees if they were satisfied with their jobs, the prevailing answer would be in the affirmative. When an employee says he is satisfied with his job he normally means he can put up with it, any feelings of frustration or repression he accepts as all in the day's work, and he accepts things rather than gets the best out of them. There is a great difference between the interpretation of being satisfied with a job and what is meant by deriving satisfaction from one's work.

An excellent indication of job satisfaction is the determination of employees to perform their task efficiently, when they speak in terms of " we " instead of " I," and when they go about their work cheerfully and enthusiastically.

Up to this stage I have spoken of the importance of engendering the correct attitudes and sentiments of the worker towards his job,

of developing ways and means whereby the worker shall derive and enjoy satisfaction from his job. What steps should be taken to achieve this ideal?

I think that a practical commonsense answer to this question can be found in the following extract from an article on "Management for More Output," which appeared in the American journal of the Society for the Advancement of Management, which I have modified to suit the needs, as I see them, of Australian industry.

"The majority of employers seem to feel that the average worker *could* do a much better job if he really *wanted* to. This poses a pertinent question: 'Why doesn't he want to?' What accounts for the average worker's indifferent attitude towards his job, for labour's unco-operative attitude toward management and capital?

Both questions can be answered in a single word—*leadership*. The leadership of industry presumably resides in management. Management, however, has displayed a singular lack of understanding regarding the nature and obligations of leadership. It has failed to recognise that the value of leadership can be judged on the basis of *effectiveness* as well as ethics; that as Hitler so tragically demonstrated, leadership may be downright evil in terms of its objectives and at the same time be "good" in the sense that it is effective in influencing people. As a result, management has indulged in too much self-pity over the "bad" leadership the worker has received from organised labour, too little self-searching regarding the shortcomings of its *own* leadership."

Management must take a more realistic view of this all important question of leadership, it must examine the opportunities of leadership which are available and influence the quality and quantity of the workers' production in respect of:—

(1) The character and ability of the worker.
(2) The nature of his job.
(3) The introduction to his work.
(4) The methods, tools and equipment and other opportunities for first-rate performance provided him.
(5) The reward given him for good performance.
(6) The supervision or leadership he receives.

It should be possible for management to improve its control and influence over these factors—and it is possible for management to improve its leadership in terms of all six factors.

However, three additional steps are necessary to make better leadership effective, namely:—

(1) To sell the employees the idea of giving better performance.
(2) To find means whereby the skills and attitudes required for better performance are developed.

(3) To follow up and check that better performance is forthcoming.

Patience, ingenuity and no little courage will be required to work out the many important details of a plan to improve leadership within industry, but the reward of better performance from the average worker, and knowing, that in achieving this end, valuable contribution to our national economy will accrue, makes the effort worthwhile.

A suggested plan of " Human Engineering in Industry " which we might adopt to assist us in our efforts to improve the efficiency of the human factor in industry might well be :—

(1) Analyse Management's present leadership in respect of each of the six factors which determine the quality and quantity of the workers' output.

(2) Plan for better control or influence over these factors.

(3) Sell these plans to the executive, supervisory and worker personnel.

(4) Develop the skills and attitudes required for first rate performance in such manner as to ensure the active and willing co-operation of the workers.

(5) Follow up to make sure that the plan is carried out at each level of the organisation.

However, in putting such a plan into operation we must not approach the problem or use the methods and points of view of the engineer and attempt to apply these to the solution of the human problems in industry. To some degree we are liable to transfer our engineering mode of thought to the field of human relations, thereby distorting our apprehensions of our human problem and seriously misdirecting our efforts to deal with them.

If we consider closely our generally accepted theories of organisation, we cannot help but note a curious parallel to the machine. Actually, our ideal of an effective organisation is a " smoothly running machine," an organisation in which all parts function smoothly, with a minimum of friction and maximum economy of effort. Each component is carefully designed for its particular task, and the whole responds automatically to the touch of the operator's hand.

The nature of human organisation cannot be properly understood in terms of mechanistic concepts. The machine and its component parts have only one purpose—that for which the engineer designed them. The purpose of a human organisation, whether business or otherwise, can be defined only in terms of the purposes of the people in it. Unlike the component parts of a machine, the people who comprise a human organisation are something more than just

parts of that organisation. They are flesh-and-blood men and women, with sentiments, ambitions, and needs of their own, ranging far beyond the confines of the organisation. The extent to which these people serve the needs of the organisation willingly and enthusiastically, depends upon the extent to which the organisation serves their needs as sentient, aspiring human beings.

In these circumstances, the effort to apply primarily technical rather than social skills to the solution of social problems is likely to have grave consequences, since the two kinds of skills are not synonymous and not mutually interchangeable. Elton Mayo, in his book, " The Social Problems of an Industrial Civilisation," draws the following distinctions between the two skills :

" Technical skill manifests itself as a capacity to manipulate things in the service of human purposes. Social skill shows itself as a capacity to receive communications from others, and to respond to the attitudes and ideas of others in such fashion as to promote congenial participation in a common task."

Unfortunately, the social skills required for effective co-operation have not been developed to anything like the degree that technical skills have been developed, therefore, if we are to function as effectively in solving our human problems as we do in solving our technical problems, we must develop as high a degree of conscious skill in the field of human relationships as the engineer has developed in his.

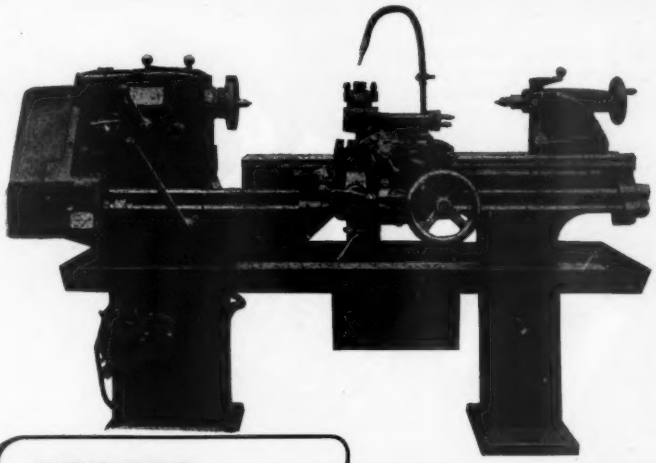
This is a sizeable task and one which cannot be accomplished overnight. For one thing social skills are poorly understood, and until they are more precisely identified, classified and described, they are communicable and applicable only to a limited degree.

A great deal of creative work along these lines is being carried out in our universities, and other educational institutions, however, the various problems of the human aspect of industry cannot be left until such times as the work of the social scientists comes to fruition.

Faced with such problems as we are now, we must deal with them to the best of our ability. But we can at least make a start —and I suggest it be a conscious start—a purposeful effort to develop a higher order of skill in the sphere of Human Engineering in Industry.

References

" Teamwork in Industry "—F. J. Burns Morton.
" The Human Factors in Management "—Schuyler Dean Hoslett.
" Personnel "—American Management Association.
" Advanced Management "—The Society for the Advancement of Management.
" Human Relations Casebook "—Drake and Drake.



WM 70 JUNIOR 7" CENTRE LATHE

1. INVERTED VEE AND FLAT GUIDES
2. DIAGONALLY BRACED BED
3. SINGLE LEVER SELECTION OF SLIDING AND SURFACING FEEDS
4. TENSION MOUNTED LEAD SCREW WITH BALL THRUSTS
5. HEAT TREATED NICKEL STEEL GEARS ON MULTI-SPLINE SHAFTS

The NEW WOODHOUSE & MITCHELL 70 Junior has been developed to provide a robust 7" centre lathe suitable for production or for general machine shop service. Simple and straightforward in design, this lathe has become popular because of its easy operation and maintenance. There is a choice of two types of feed box, either Norton quick-change or the three-feed type. The diagonally braced bed has an ample gap, and separate vee guides to saddle and tailstock are points which deserve emphasis.

Briefly, the 70 Junior is worthy of a place in any machine shop where economy of operation, accuracy and reliability are primary considerations.

MERCHANTS SUPPLIED

Complete specification on request

WOODHOUSE & MITCHELL

(PROPRIETORS · THOS. W. WARD LTD.)

WAKEFIELD ROAD · BRIGHOUSE

TELEPHONE: BRIGHOUSE 627 (3 LINES) · TELEGRAMS: WOODHOUSE, BRIGHOUSE

WM/2

INDEX TO ADVERTISEMENTS

C
S

CHUCKS FOR MODERN HIGH SPEED DRILLING PRODUCTION

THE "MARVEL" KEYLESS & THE "ARCHER" KEYLESS DRILL CHUCKS

are designed and constructed to stand up to modern drilling practice. The external design is robust and serves as an efficient casing to protect the internal mechanism. The jaws are protected from damage by the specially hardened boss or cap. The demand for this perfect chuck increases every year, evidence that the leading engineers appreciate its worth.

FIVE SIZES FROM ¼in. TO ⅝in.

ASK FOR OUR CHUCK CATALOGUE 5G

The "ARCHER" KEYLESS DRILL CHUCK

is a correctly designed small size chuck working on the same principle as the "Marvel" which ensures reliable grip and ease of release. It has permanent concentricity and perfect balance for high speed drilling.

TWO SIZES: 0-½ in., 0-⅝ in.

TURRET STYLE *"Marvel"*

Shanks made solid from body giving short overhang for rigidity and alignment.
Tools quickly changed by hand without disturbing chuck setting.
Made in all capacities and various shank diameters

FRANK GUYLEE & SON Ltd.

'ARCHER' TOOL WORKS, MILLHOUSES · SHEFFIELD, 8

All communications regarding advertisements should be addressed to the Advertising Managers, T. G Scott & Son, Ltd., Talbot House 9. Arundel Street, London, W.C.2. Phone: Temple Bar 1942. Printed by Maxwell Love & Co., Ltd., Bradley's Buildings. White Lion Street, London. N.1

gers.
1942.
N.1